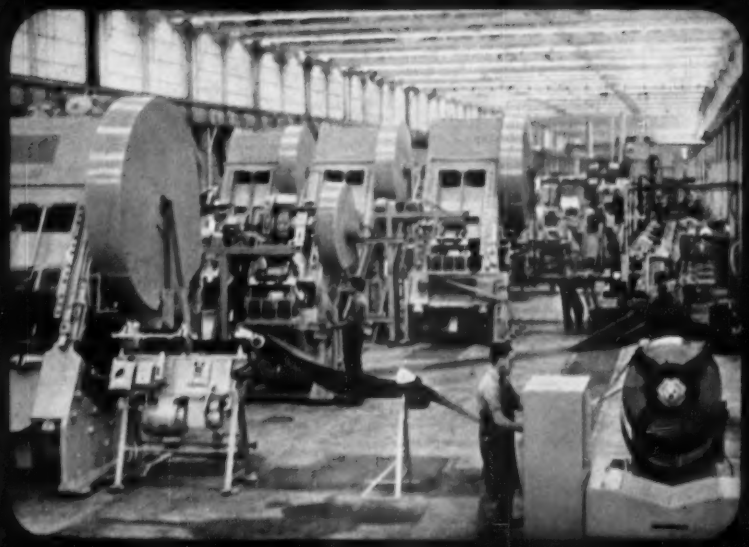
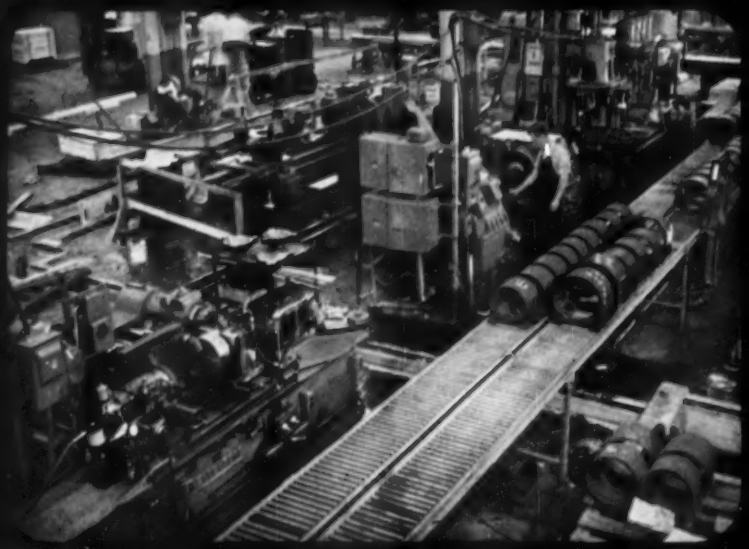
American Machinist

McGRAW HILL MAGAZINE OF METALWORKING PRODUCTION

DECEMBER 17, 1956

PRICE 50 CENTS





Automated Motor Making...

Automation was the keystone of planning for GE's medium-induction-motor plant in Schenectady. Here are three typical setups: the head end of a standard motor line (above), frame machining on a special line (left), and dynamic balancing of the rotor-and-shaft assembly (below). How the plant was planned is the subject of our lead article.

- **Non-Destructive Tester for Sandwich Bonds**
- **Logic Functions for Process Control**
  A SPECIAL REPORT

Heald RED HEAD'S extra precision and low maintenance

NOW AVAILABLE TO ALL USERS

of boring and internal grinding equipment

HEALD Red Head Boringheads and Wheelheads have achieved an enviable reputation for extreme precision and exceptionally low maintenance, on Heald Bore-Matics and Internal Grinders in use throughout the entire metalworking industry. Heretofore, they have been available only as original equipment or replacement items for specific Heald machines.

Now, however, in response to a continual and ever-increasing demand — and in line with the Heald policy of building standard machines and parts — it has been decided to market all standard Red Head Boringheads and Wheelheads without restriction wherever practical. This means that the extra precision and low maintenance provided by Heald Red Heads are now available to all users or manufacturers of metalworking equipment, regardless, in most cases, of the type of machines on which they will be used.

The standard head types and sizes that can be supplied are fully described and listed in the Bulletins noted below.

RED HEAD
HEALD

HEALD PERMANENTLY-LUBRICATED BORINGHEADS

Designed to provide high, sustained precision with virtually no maintenance, Heald Red Head Boringheads are permanently lubricated —no grease or oil is ever needed. They run cooler, reduce heat distortion and maintain high accuracy at all speeds and loads. Spindles run in precision bearings, specially manufactured to Heald specification and individually tested and selected for each head. Write for Bulletin 5-1, Issue 6.

HEALD HI-FREQUENCY WHEELHEADS

Providing proper speed for small-bore grinding, Heald Hi-Frequency Wheelheads deliver full power direct to wheel and eliminate drive upkeep costs. They can withstand momentary peaks of twice the continuous-duty rating. Those running over 30,000 rpm must be automatically lubricated by the Heald Oil-Mist system which also supplements effects of water cooling—others are permanently grease lubricated. Write for Bulletin 6-2, Issue 2.

HEALD PERMANENTLY-LUBRICATED WHEELHEADS

Heald Red Head Wheelheads incorporate the same high quality bearings and permanent, sealed-in lubrication as Heald Red Head Boringheads. They have repeatedly set the highest standards of accuracy, precision and surface finish. There are three general types: Quill Style, for a variety of work — Naked Style for high production on a single workpiece — Sleeve Style for large bores. Write for Bulletin 6-1, Issue 7.

IT PAYS TO COME TO HEALD

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VOLUME 100, NUMBER 27

Here's how we designed an automated plant . . . What was the thinking behind the "most modern plant in the world?" Why were certain choices made? *By R L Hiller, General Electric Co.* 105

Sparton makes trailers on a production line . . . An Oklahoma plant combines the skills of an aircraft manufacturer with the production ideas of the Middle West. *By W H Shelton, Sparton Aircraft Co.* 110

Adjustable backarms and toolblocks speed setup . . . Tooling of Fay automatic lathes is simplified by this addition. *By Robert C Greer, Caterpillar Tractor Co.* 114

Report on Russia: research and training . . . Third in our series of on-the-spot reports on what is happening to Soviet metalworking 116

Electrolytic grind triples cam output . . . Internal grinding speeded by converting Size-Matic to electrolytic cutting 120

Ultrasonic vs radiographic inspection of bonds . . . The next two articles describe the two methods. This introduction compares and evaluates them. *By Earl R Weiher, Convair-Ft Worth* 121

Adhesive-bonded joints tested by ultrasonics . . . Mechanical impedance method of testing detects voids, and may detect sub-standard bonds. *By E L Gray, Convair-Ft Worth* 122

Radiography tests brazed stainless sandwich . . . The first summary, with typical radiographs, of this method. *By S Maszy, Convair-Ft Worth* 125

Forced responsibility trains operators . . . Temco trains machine-tool operators in 100 hr. Major trick is to pick 'em carefully to start with. *By E J Tangerman* 128

Standard scaffolding saves $500,000 on KC-135 . . . On-the-spot assembly of standard tube and fittings makes any size or shape of scaffold needed 132

SPECIAL REPORT NUMBER 436

Logic functions . . . key to metalworking control . . . What the four simple functions are, where they are used, and how they are combined into both simple and complex controls. *By William M Stocker, Jr.* 137

REFERENCE BOOK SHEETS

Positive knockouts and strippers I, II . . . Some of the most practical methods summarized. *By Allan Young, Collins Radio Co.* 147

Sleeve-bearing alignment . . . Basic reasons for interference and a formula for clearance. *By R J Sollohub, General Electric Co.* 151

American Machinist *Chips*

Cover . . .

Three views of GE's fabulous Building 85, the "most modern motor plant in the world." R L Hiller (see biography below) describes the thinking behind this plant in the article on page 105.

Machine Control . . . A year or two ago, Westinghouse introduced a new type of machine-tool control system made up of "logic function devices." Recently General Electric has announced a similar unit. These switching systems perform without moving parts and are available in various combinations to handle different signal input and output requirements. They are likely to be a major factor in machine-tool control.

To give a simple explanation of logic functions, and there are only four of them, Associate Editor Bill Stocker has prepared the Special Report in this issue. The logic functions are explained, along with demonstrations of how they are combined into both simple and extremely complex controls. We won't describe the four functions here. Turn to page 137 and let Bill do it for you. We guarantee you'll come out of this elementary tour into higher mathematics with a new understanding of this area of control.

Honeycomb has reached the stage where we must consider it as a material, along with the basic metals. But honeycomb is not one material—it is a collection of many combinations of core and skin assembled in many ways. One major problem is testing of the finished material and Executive Editor E J Tangerman has put together a discussion of this problem with two articles describing radically different methods of non-destructive testing. It starts on page 121.

Russian research in machine tools is the subject of the third in our series of exclusive, on-the-spot reports from Moscow. The first installment gave the background of development in Russian metalworking (*AM*—Nov 19 '56, p 121), the second outlined the Soviet plan for topping US output by 1960 (*AM*—Dec 3 '56, p137) and you'll find the third installment of this vital series on page 116.

Coming . . . *AM* for Dec 31 describes the technique required to weld zirconium, there is a summary of Russian progress in high-speed machining. To add to the international flavor, we have a report on cold extrusion of steel from Czechoslovakia and a report on high-rake cutters from England. Other articles will report on fire-resistant hydraulic fluids and suggest ways to save on cutting costs short of buying a new machine. Plus several other articles and all the usual departments.

Richard L Hiller . . . is a plant layout-materials flow engineer for the General Electric Co. In this capacity he played a key role in the design of the automated motor plant in Schenectady (shown on our cover and described on page 105). Born in Canajoharie, NY, he studied at the McCallie Prep School in Chattanooga, the University of North Carolina at Chapel Hill, Pace College in New York City, and Syracuse University. After four years with Remington Arms as a tool heat-treat specialist, he joined GE in 1951 as a planning and method specialist.

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American Machinist is indexed regularly in the Engineering Index and the Industrial Arts Index

American Machinist, published bi-weekly, with an additional issue in mid-November, by McGraw-Hill Publishing Company, Inc. James H McGraw (1860-1948), Founder.
EXECUTIVE, EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd Street, New York 36, NY. Donald C McGraw President; Paul Montgomery, Executive Vice President; Joseph A Gerardi, Vice President and Treasurer; John J Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B Smith, Vice President and Editorial Director; Joseph H Allen, Vice President, Director of Advertising Sales; J E Blackburn, Jr, Vice President and Circulation Director.
SUBSCRIPTIONS: Address correspondence to American Machinist-Subscription Service, 330 West 42nd Street, New York 36, NY. Allow one month for change of address. Subscriptions are solicited only from production executives and engineers in the metalworking industries. Position and company connection must be indicated on subscription orders.
Single copies, 50c. Subscription Rates—United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada $7 for one year, $11 for two years, $14 for three years. Other Western Hemisphere and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Second-class mail privileges authorized at New York, NY.
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SPIRAL BEVEL GEAR

HYPOID PINION

How to produce both with just *one* cutter, *one* machine

These two parts alone show why the Unitool* Method is ideal for economical job shop operation, for trying new ratios, and for producing prototypes.

You need only one machine—either the No. 116 Hypoid Generator or the smaller No. 106—and one cutter to produce both parts.

You complete both parts from the solid before removing them from the machine.

Add just five more cutters and you are equipped to produce spiral bevel and Zerol® bevel pairs of any ratio, and hypoid pairs of 3:1 ratio and higher. You can cut any of these gears up to 18″ pitch diameter.

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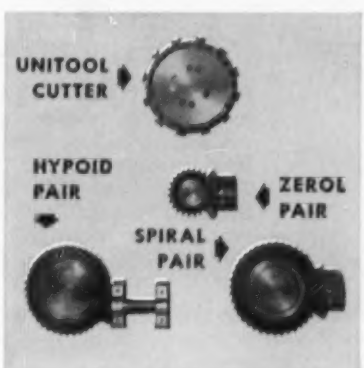
No special training needed The operator uses direct common sense methods to set for the correct tooth thickness and position of contact. No lengthy, expensive training is necessary.

Fast change-overs You can switch to different sizes or types of gears in minutes. A calculated set-over is all it takes to get the right gear size. No other measurements are necessary.

Bulletins—Write for bulletins on the Unitool Method and the two generators which outline all the advantages of the method and explain its operation in detail.



With the Unitool Method you use just one cutter to produce the three types of gear pairs shown here. Such versatility cuts costs sharply on small-lot production.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

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CINCINNATI
Cutter and Tool
give you a strong secondary line

Whatever is good for the cutting edge of your expendable tools is good for production. And CINCINNATI® Cutter and Tool Grinders are certainly good for the cutting edges of all types of milling and die sinking cutters, reamers, hobs, taps and others. There are 5 machines in the Cincinnati group. They constitute an exceptionally strong secondary line of production equipment for machine tools of all types. Sweet's Machine Tool File contains brief specifications, and complete data may be obtained by writing for catalogs.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

No. 2 FILMATIC—For grinding the majority of cutters used in metalworking shops of all sizes . . . milling cutters, reamers, hobs, taps, planer tools. Host of attachments available, including Radius Grinding; Face Mill; Indexing for Workhead; Dust Exhaust; Spring Chucks and Collets. Capacity: 10" swing over table, 27" between centers. Catalog No. M-1914-2.

No 1.—A companion machine for the No. 2, or in shops using only small- to medium-sized cutters, the No. 1 will be your first choice. Timesaving features include anti-friction table slide; eccentric wheelhead swivel mounting; reversible motor built into wheelhead; three-way controls. Capacity: 8" swing over table, 15" between centers. Catalog No. M-1852-1.

Grinders of production

CONTOUR—This machine offers a big saving for shops having a volume of form milling operations. It grinds form milling cutters on the periphery of the teeth to a definite cutting clearance chosen for the work material. Contour ground cutters produce a greatly superior finish at a higher feed rate. Catalog No. M-1918-1.

MONOSET—For sharpening, repairing and making small cutters including countersinks, those required for die sinking, and other unusual shapes. Because of the universal construction, most jobs can be completed in one chucking. Built-in spiral lead mechanism generates infinitely variable helices, right- or left-hand, $1\frac{13}{16}$" min. lead. Catalog No. M-1591-3.

PROJECTO-FORM—For grinding small, accurate profile shapes on flat form cutters, lamination die parts and similar components. This machine combines grinding with an optical comparator unit. Work profile is enlarged 20 X on ground glass viewing screen directly in front of operator. Master drawings made on Layout Scribing Machine. Catalog No. M-1612-5.

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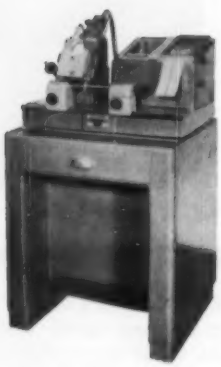
MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

THIS RED LINE

"IN



Fellows Red Liner: Automatically makes and records a composite check of all gear errors in combination. Three capacities.

THE
PRECISION
LINE

helps to keep production

THE BLACK"!

The red line on a chart from a Fellows Gear Inspection Instrument gives accurate, large-scale indication of gear errors and their nature . . . keeps production costs down by minimizing rejects. And the permanent chart gives recorded *proof* that gears meet specifications in every respect.

Whether you're manufacturing tiny, fine-pitch gears or large, coarse-pitch ones, for your own products or for customers, it pays to rely on Fellows inspection instruments. For full information, get in touch with your Fellows Representative. Write, wire, or phone any Fellows office.

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Branch Offices: 1048 N. Woodward Ave., Royal Oak, Mich.
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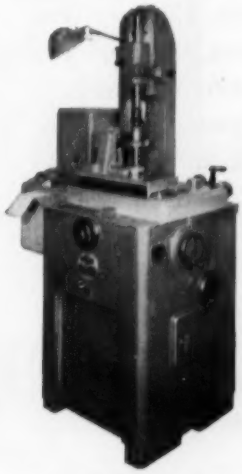
Fellows Lead Measuring Instrument: measures and electrically records the accuracy of helical and other surfaces; checks crown and taper. 12" and 24" P.D. capacities.



Fellows Involute Measuring Instrument: rapidly and easily checks involute profiles of external and internal spur and helical gears and records results. 12" and 24" P.D. capacities.

Fellows *Gear Production Equipment*

These ENTIRELY VAN NORMAN No. 16 DO THE WORK OF TWO

Save Equipment Dollars

Quill Type Adjustable Cutterhead permits horizontal, angular, and vertical milling plus boring and drilling.

These new Van Norman Ram Type Millers are designed to increase your milling production and reduce milling costs. Entirely new from top to bottom, they are engineered for maximum rigidity, cutability and accuracy.

A single investment in any one of these millers gives you the equivalent of two single purpose machines plus attachments *at the much lower cost of a single machine.*

They are available in both plain and universal models.

Write for complete details today.

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on many purchase plans—Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate.

For instance — you can purchase a No. 165 on a 5 year conditional sales contract for only $4.98 per day. See your dealer or write Van Norman Company.

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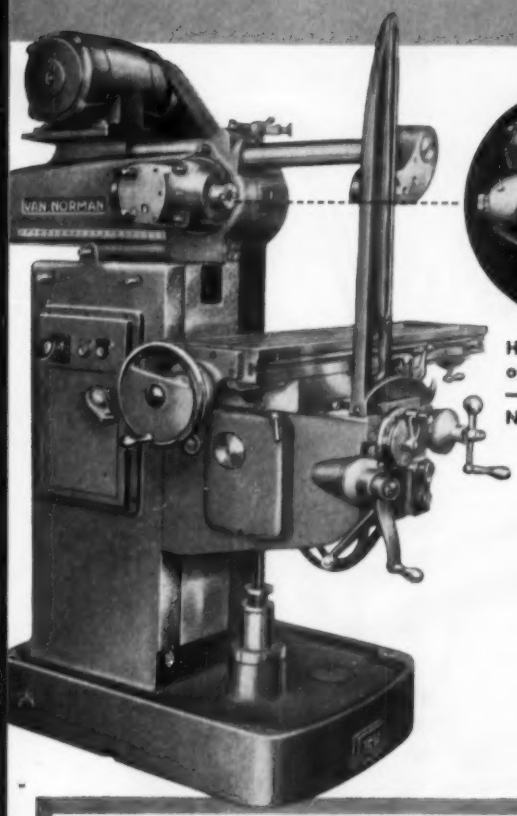
NO. 165

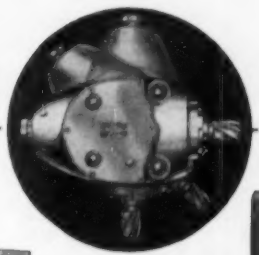
features the quill type adjustable cutterhead that makes this machine the most versatile miller available. Table: 40½" x 10"; Quill Travel: 4"; Quill Power Feeds: .0015; .003; .006; Cutterhead Spindle Motor: 2 HP.

VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

NEW...
RAM TYPE MILLERS
SINGLE PURPOSE MACHINES
..Cut Production Costs!





Horizontal, angular or vertical milling — all on one Van Norman Miller.

NO. 16M
a heavy duty, rugged miller designed for maximum rigidity and accuracy. Table: 40½" x 10"; Ram Travel: 20½"; 3 HP Cutterhead Spindle Motor.

NO. 16L
designed to increase production and cut costs in tool rooms, machine shops, pattern shops and production lines. Table 40½" x 10"; Ram Travel: 20½"; Cutterhead Spindle Motor: 2 HP.

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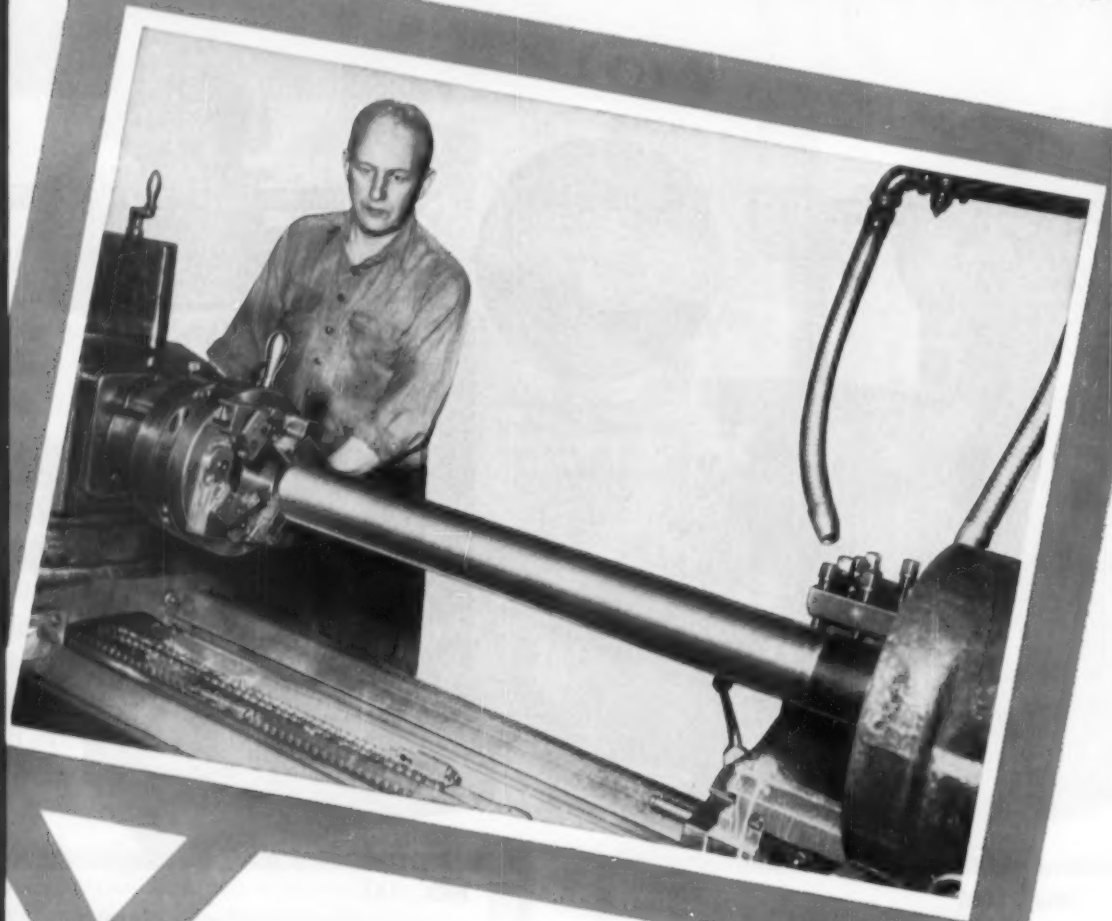


3¼" 8P threads-29" long with LANDMATIC 32AX Head

4150 steel heat-treated to 28-32 Rockwell "C" is threaded to a Class 3 fit by a LANDMATIC 32 AX Head. Rugged tangential chasers provide long life and allow threading after heat treating. Special centering throats on these chasers eliminate the out-of-round condition common in long workpieces.

This stationery self-opening head is used on a 3A Warner & Swasey turret lathe to thread tie bars for plastic injection molding machines at the Reed Prentice Corp., Worcester, Mass.

The 32AX LANDMATIC Head will thread workpieces up to 4" in diameter through the bore, and cut 8 pitch or finer threads up to any practical length. By using oversize chaser holders short lengths of threads can be cut on larger workpieces up to 6¼" in diameter. A larger head, the 40AX, features a six-chaser design to give greater distribution of cut and greater support to large diameter workpieces. This head will cut threads up to a maximum of 9¼" in diameter with the same pitch limitations.

☆ ☆ ☆

For more information on the 32AX LANDMATIC Head, send specifications and ask for Bulletin No. F-90.

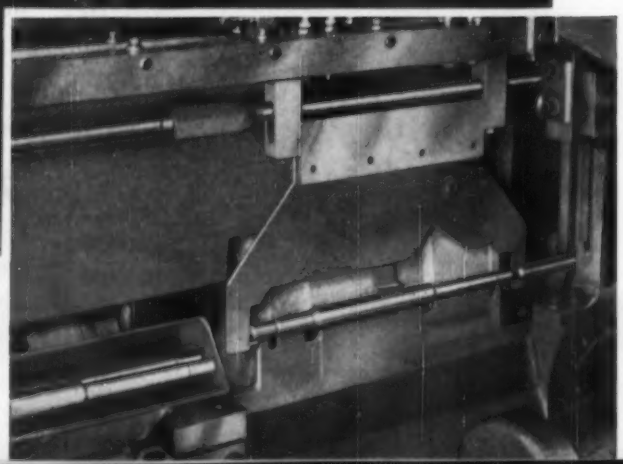
LANDIS Machine COMPANY
WAYNESBORO • PENNSYLVANIA • U. S. A.

405-2C

Cuts Both Grinding and Inspection

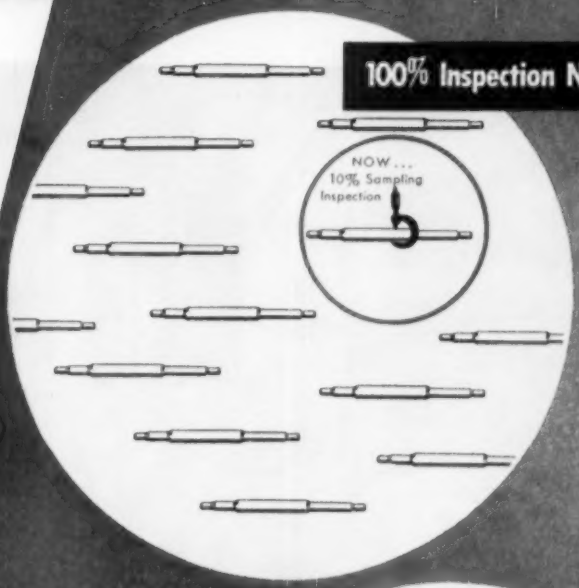
Improves work uniformity from .0007" to .0003"

Since using two Landis No. 12½ Centerless Grinders, a major automotive parts manufacturer is now grinding shafts with these results. The superior accuracy of these grinders at high production rates is due to their unmatched rigidity.

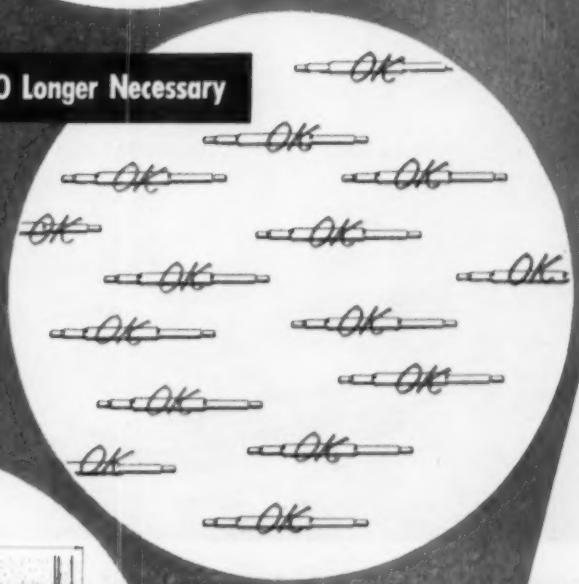


Costs

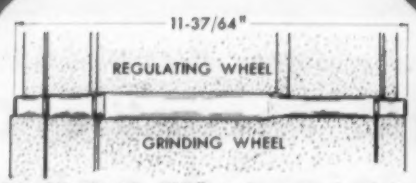
100% Inspection NO Longer Necessary



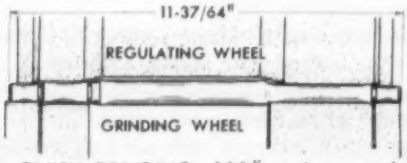
10% Re-runs NO Longer Necessary



Grinds 380 Shafts per Hour



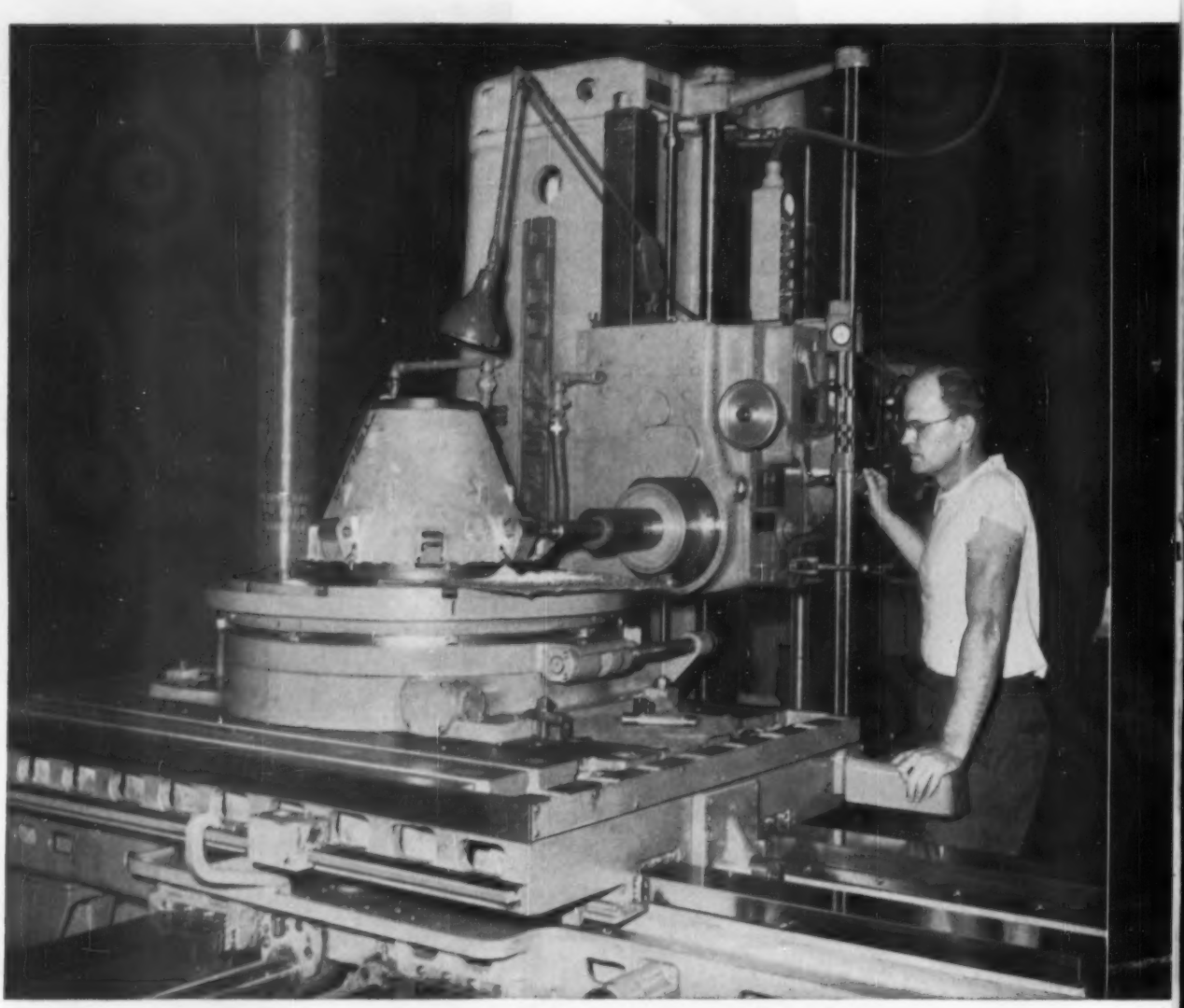
ROUGH GRINDING: .010" stock removal—5 diameters



FINISH GRINDING: .003" stock removal
—4 diameters

LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

LANDIS
precision grinders



OPERATIONS: drilling, boring, reaming of upper housing **MACHINE: G&L Model 340-T**

2 versatile G&L precision machining

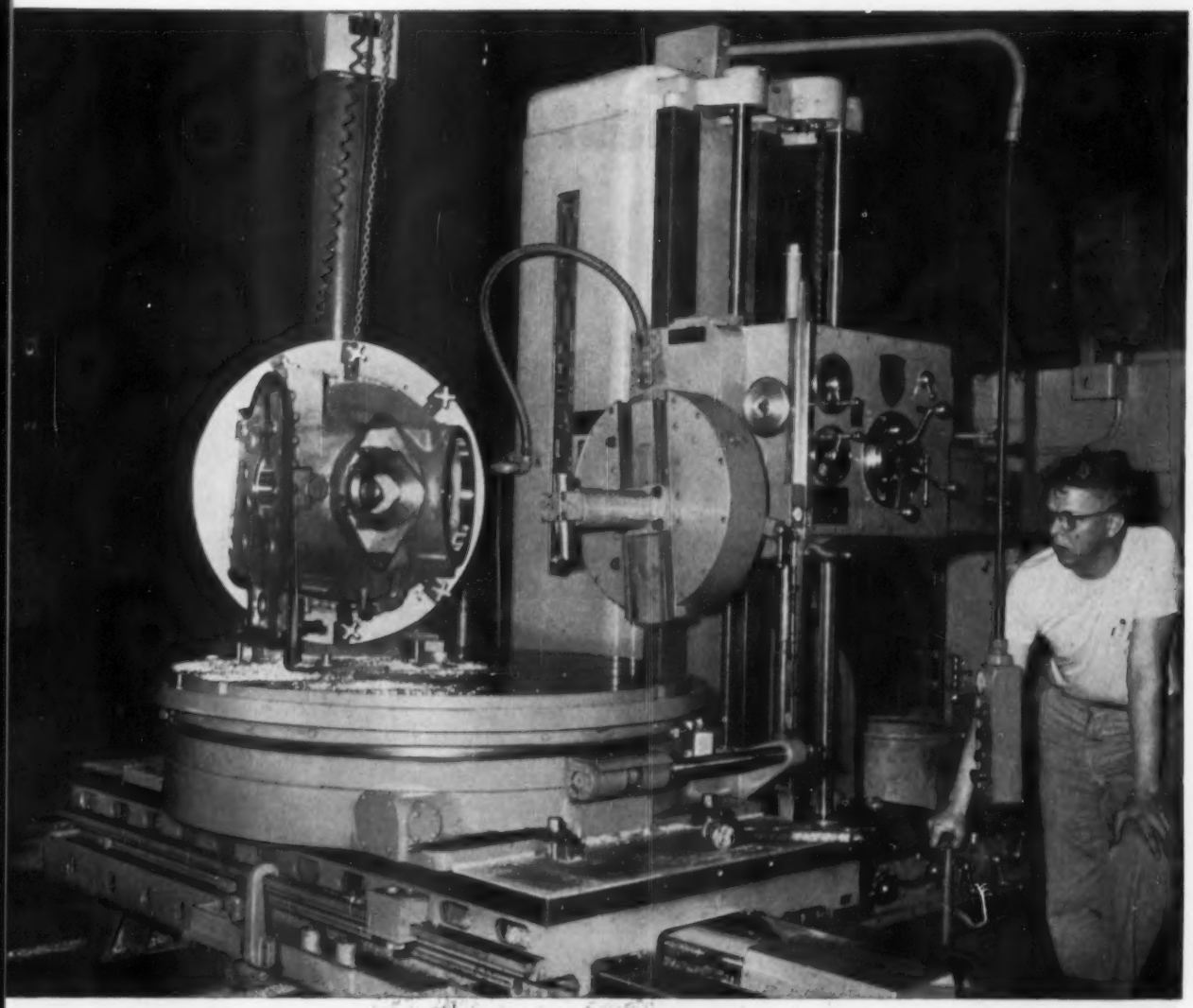
Precision-machining to tolerances within .001" in a single set-up. That's what Indiana Gear Works, Indianapolis, is getting with two highly versatile Giddings & Lewis horizontals, producing intricate housings for Sikorsky helicopters.

Model 340-T, equipped with a 4-inch spindle, drills, bores, reams and mills four equally-spaced lugs (90° apart) on the upper housing. And the Model 300-T with a 3-inch spindle and continuous feed facing head, precision turns, bores and faces two holes — 10.503" and 4.377" in diameter — on the lower housing.

G&L *and* HYPRO DIVISION.....

GIDDINGS & LEWIS MACHINE TOOL CO.

Fond du Lac, Wisconsin



OPERATIONS: turning, boring, facing of lower housing **MACHINE: G&L Model 300-T**

horizontals perform for Sikorsky helicoptors

Both workpieces require machining to tolerances within .001" in a single set-up.

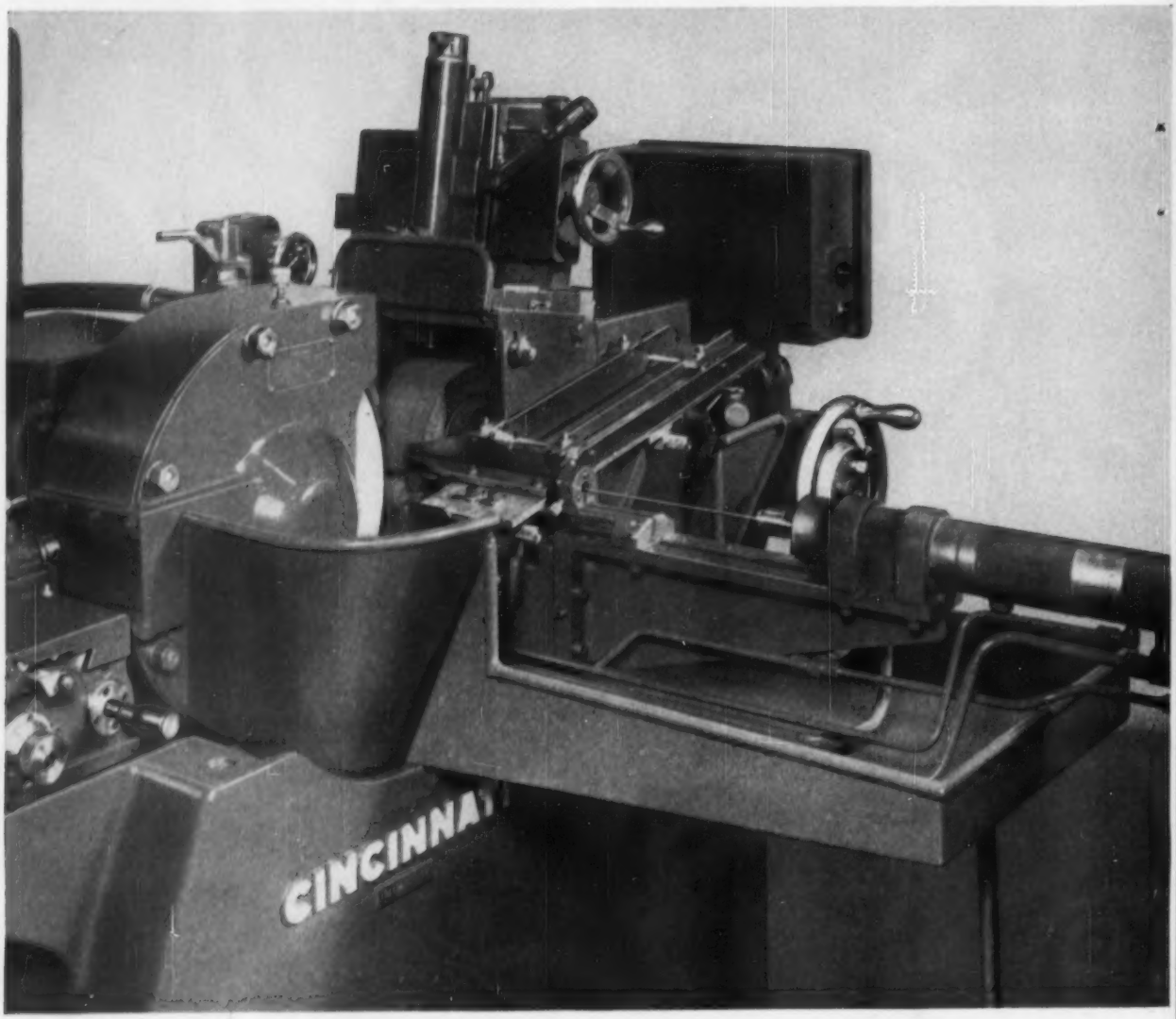
The two horizontals, illustrated here, also feature G&L's rotary indexing table and the improved measuring device which facilitates accurate positioning through the use of measuring rods and dial indicators.

If you, like Indiana Gear Works, require precision production of intricate components, you can do it on a G&L horizontal. Call in your G&L representative. He'll be glad to help you get results.

G-65

• • • • *Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX machines.*

Cincinnati Filmatic



Letter size straight shank twist drills, No. 60 to ¼" diameter, are ground on the CINCINNATI FILMATIC No. 0 Centerless illustrated above. Operation: grind diameter and back taper. Production: 16 drills per minute. In addition to the magazine feeding attachment and loading device shown in the illustration, equipment includes a "Roto Feed" Infeed Attachment. It automatically advances and retracts the regulating wheel slide, at selective rates up to 30 cycles per minute. Tooling by Cincinnati Centerless Grinding specialists.

CINCINNATI

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Nos. 0 2 3 4 5 6 Centerless

The No. 0 is the machine for this job . . . grinding diameter and back taper on small drills

FILMATIC

Low, low cost of machining operations is essential for competitive pricing of small drills. One manufacturer does an excellent job by grinding the diameter and back taper on CINCINNATI® FILMATIC No. 0 Centerless Grinders.

The machine operates at a very high rate of production, grinding 16 drills per minute (768 per hour at 80% operating efficiency) to high standards of quality and at negligible cost.

You'll want to know why the No. 0 . . . one of six sizes of Cincinnati's line of standard Centerless Grinders . . . does such a fine job of grinding small parts. Spindle bearings are the exclusive FILMATIC type that never wear out; lubrication is automatic; regulating wheel speeds are infinitely variable; 5 hp drive; readily automated. Capacity: up to ½" diameter. Want more information? Look in Sweet's Machine Tool File, or write for a copy of catalog No. G-640-1.

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO

CINCINNATI FILMATIC
No. 0 CENTERLESS
GRINDING MACHINE
CATALOG No. G-640-1

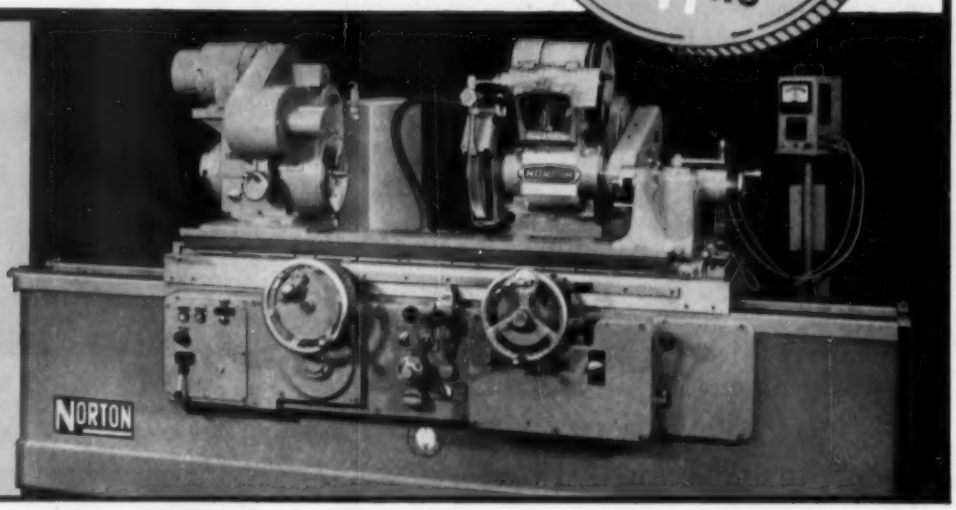
GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Two new Norton Universal Grinders...

QUICK "GET-AWAY", one of the biggest advantages of the new Norton 14" and 18" Type U-4 universal grinders, shifts the time-and-money-saving "Touch of Gold" from one type of grinding to another — fast.

14" and 18"...feature extra versatility... extra fast set-ups...

to bring you extra profits



NEW SIZES — NEW ADVANCED FEATURES
The popular Norton Type U-4 universal grinders are now built in 14" and 18" capacities. Note optional SWIVALIGN Unit on right of machine.

Designed for external, internal, face and angular wheel slide grinding, Norton Type U-4 universal grinding machines — in the new 14" and 18" work capacities — bring you all the famous Type U-4 features. For example:

Extremely rapid chucking, through advanced design of the headstock spindle . . . quick change-over to live or dead spindle operation . . . easy work speed change in a range of 60 to 360 r.p.m. . . . independent settings of wheel and feed for doing difficult jobs fast . . . extra capacity in wheel head and headstock . . . precise swivel table alignment with the SWIVALIGN* Dual Electric Indicator, an optional extra.

***PLUS** these new advancements:*

- **Wide work speed range from AC power source with full horsepower over the entire speed range.**
- **Steel-tape-type base way guards protect the ways and require no additional floor space.**
- **Wheel spindle runs in hard bronze bearings which enclose spindle and support over 50% of spindle body.**
- **Footstock spindle remains in retracted position for loading.**

Other Norton Universal Grinders
include the 10" and the Type U-4 12". You can depend on this complete Norton line of Norton universal grinding machines for speed, versatility and accuracy over the widest range of different grinding jobs. For complete facts on the new 14" and 18" Type U-4 grinders — or any other Norton machines — see your Norton representative or write us direct. And remember: only Norton offers you such long experience on both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

District Offices:
Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

$7200 per month saving by large automotive plant after switching to

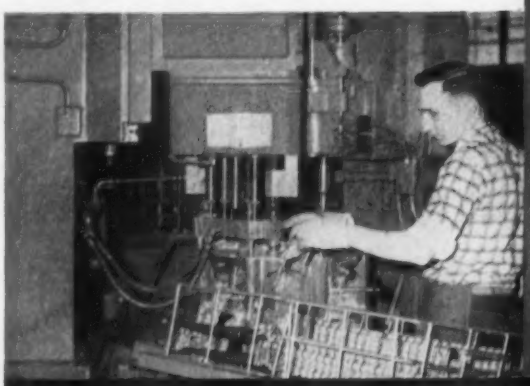
DASCO D-20

HEAVY-DUTY SOLUBLE OIL

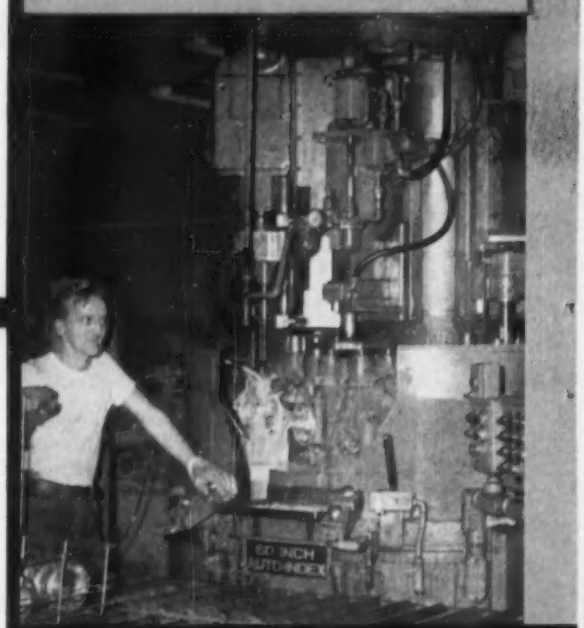
An actual saving of $7200 per month, including labor costs, has been reported by a large automotive transmission plant since switching to Stuart's Dasco D-20—*the first truly heavy-duty soluble oil* formulated and priced for general application!

ONE OIL FOR 365 DIFFERENT MACHINES—This carefully engineered compound eliminates cutting oil confusion—drastically reduces the number of cutting fluids needed in your plant. This plant uses economical Dasco D-20 in standard mixtures on *365 different machine tools*—reducing cutting oil inventory . . . saving service time and cutting oil costs . . . minimizing chance of error—yet taking advantage of all lubricating and cooling properties you expect from a heavy-duty soluble oil.

RANCIDITY ELIMINATED—This user reports that Stuart's Dasco D-20 stays sweet longer—even after long shutdowns. Rancidity is actively resisted by a special germicide additive, the best of a very few germicides that remain effective in the presence of soaps. Stuart's Dasco D-20 has superior wetting ability—remains effective when mixed with water.



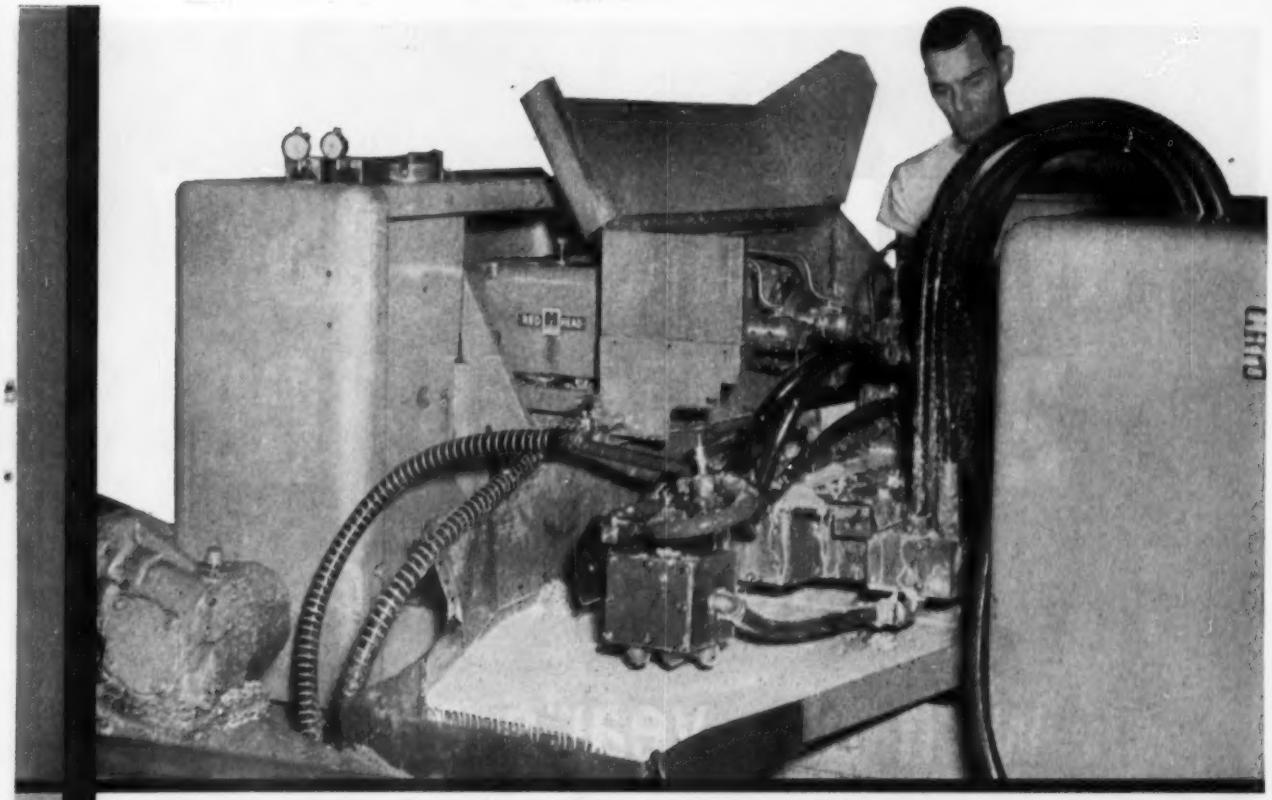
Chips settle faster with Stuart's Dasco D-20, so you have a clean compound in your machine at all times. You get a better finish . . . cooler cutting and grinding.



You can use low-priced Stuart's Dasco D-20 for reaming, boring, drilling, facing, chamfering, milling, tapping, threading, broaching, surface-grinding, and high-speed carbide tool machining.

For Cutting and Grinding

Stuart's Dasco D-20 maintains or improves efficiency of your cutting and grinding operations. A real heavy-duty emulsifiable oil, it forms a tough, thin film between the cutting tool and the work . . . reducing friction and preventing excessive heating. A wide variety of tough metal-cutting operations, including certain types of broaching, can be done with this *one* low-priced compound. A lean mixture for grinding enables you to take full advantage of improved wheel bonds. Properly applied, it allows you to use high-unit pressure for maximum stock removal . . . keeps wheels open and free-cutting . . . prevents heat checking.



First low-priced heavy-duty soluble oil with both additives: active germicide and E. P. base

Stuart's Dasco D-20 is the first low-priced soluble oil to offer you both a special anti-rancidity germicide and an extreme pressure base oil additive with high anti-weld and lubricity characteristics. Carefully balanced, high-quality emulsifying agents provide high-grade cooling properties . . . unusual stability for longer life. This multi-purpose, heavy-duty soluble oil gives you ideal characteristics for high-speed machining with carbide cutting tools . . . upgrades finish and tool life on tool steel applications. Stuart's Dasco D-20 has superior wetting ability . . . avoids rust . . . mixes easily . . . keeps machines and parts clean . . . and is preferred by operators.

Phone your
Stuart Service Center

Arrange now to test Stuart's Dasco D-20 on your difficult cutting and grinding jobs.

DETROIT, MICH. . . . . Tyler 7-8500
CHICAGO, ILL. . . . . Bishop 7-7100
HARTFORD, CONN. . . . . Jackson 7-1144
CLEVELAND, OHIO. . . . . Prospect 1-7411
PHILADELPHIA, PA. . . . . Devonshire 8-6100
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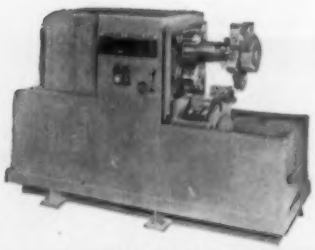
Stuart

METALWORKING LUBRICANTS

WARNER & SWASEY 2 AC AUTOMATICS

pay for themselves with one year's savings at Thew Shovel Company

Cost savings from 47% to 77%! That's the production record of two Warner & Swasey 2 AC Automatics on small and medium lot work at Thew Shovel Company, Lorain, Ohio. Annual dollar savings exceed the cost of both machines plus tooling! On small and medium lot work these automatics can undoubtedly return substantial savings for you. To discuss their application to your work, call in our Field Engineer.



1 AC CHUCKING MACHINE
8" or 10" Chuck—6" Working Stroke

2 AC CHUCKING MACHINE
10" or 12" Chuck—9" Working Stroke

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS ... WITH A WARNER & SWASEY

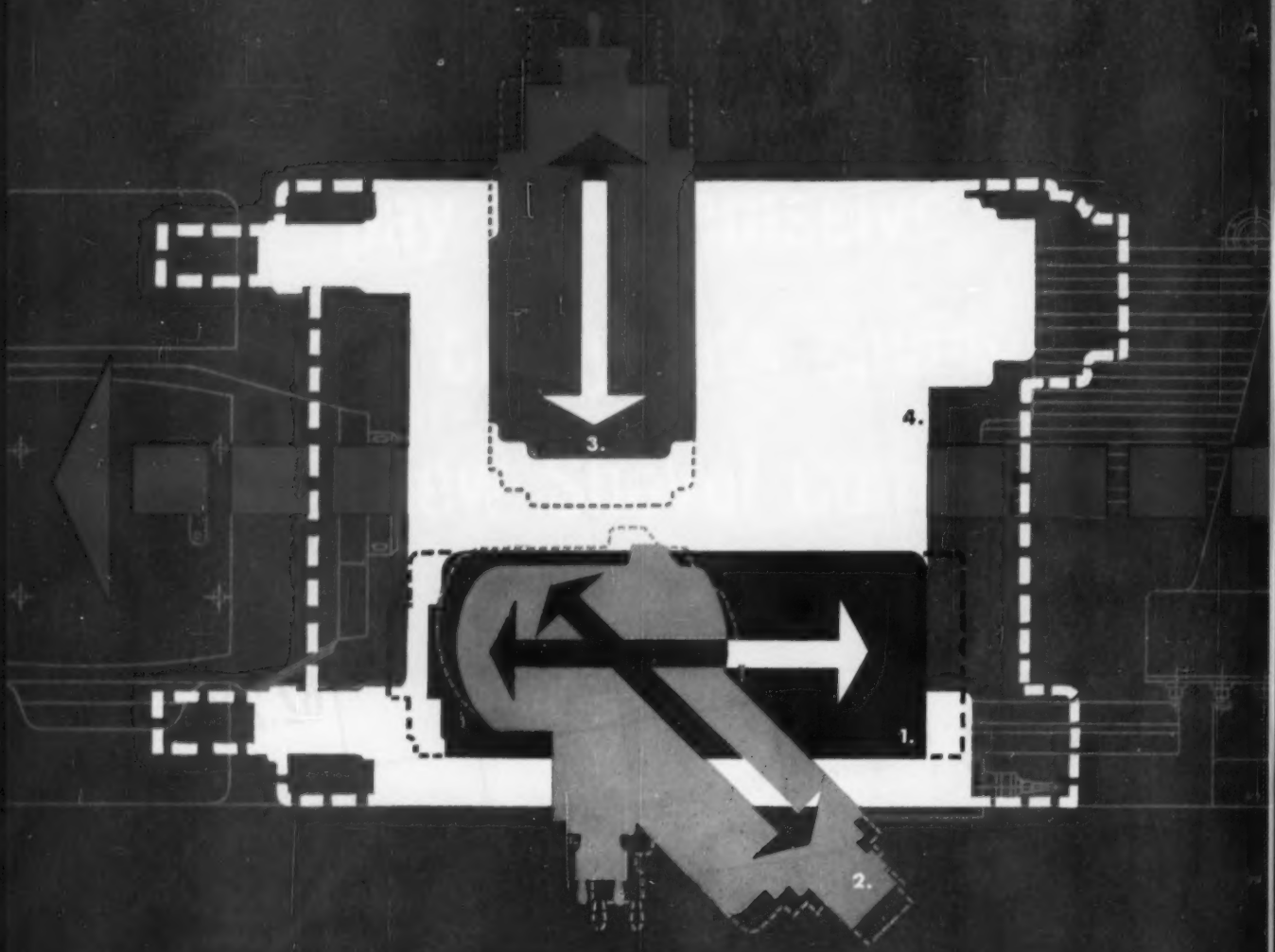
PRODUCTION RECORD

PART	PART NAME	OLD TIME	NEW TIME	MONTHLY TURNOVER	% SAVINGS
	Pinion	.280 hours	.087 hours	100	69.0%
	Roller	.392 hours	.087 hours	2000	77.8%
	Sprocket	.376 hours	.177 hours	175	52.4%
	Roller	.373 hours	.126 hours	447	66.2%
	Roller	.372 hours	.141 hours	109	62.2%
	Spacer	.074 hours	.039 hours	770	47.2%
	Box	.431 hours	.193 hours	108	55.6%
	Box	.504 hours	.231 hours	36	54.0%

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

ACTION That's the Word for Hydra-Slide!

ARROWS SHOW SLIDE MOVEMENTS OF MONARCH'S NEW AUTOMATIC CYCLE CHUCKING LATHE



1, 2. Basic unit, most models—hydraulically operated front slide unit, on which is mounted famous Monarch Air-Gage Tracer. Utilized generally for straight or contour turning, facing, or boring.

3. Hydraulically operated rear slide unit for necking and grooving—is ideal with proper tool setting for facing, for which hydraulic automatic tool relief is provided.

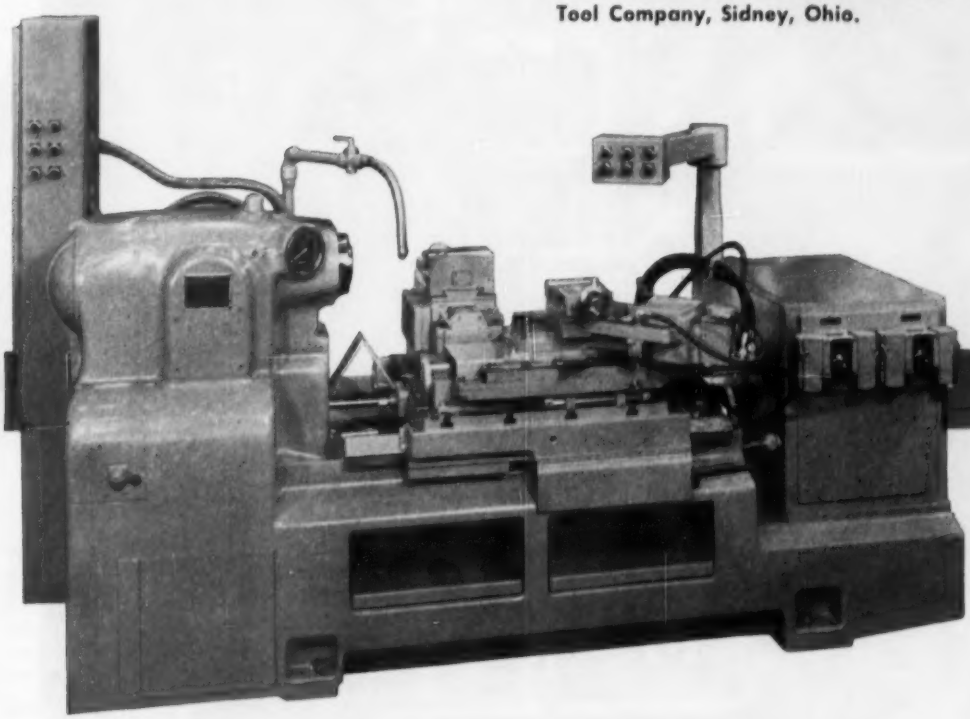
4. Platen with hydraulic movement, on which both front and rear slide units are mounted. Speeds cycle for work piece change!

HERE'S ACTION in the fight against rising production costs—with a fully automatic cycle controlling an extremely effective combination of hydraulic slide movements. Look them over! Here's an exceptionally versatile, high production chucking lathe for both first and second operation work.

Although the typical cycle presumes a tool or tools on both front and rear slides, and is based on the ideal production-wise situation of simultaneous operation of slides—the versatility of the machine is such that many variations can be set up. Of course, there are convenient all-electrical controls for effortless and positive setup.

The Hydra-Slide has ample capacity as to work size and stock removal both, with work diameter capacity up to 15" over front slide unit —up to 13" over rear slide unit—and work drive motor ratings up to 20 H.P.

Here's action—production-wise and cost-wise! You should know *all* about a machine like this. Send the coupon today for our complete illustrated booklet #1703—**The Monarch Machine Tool Company, Sidney, Ohio.**



The Monarch Hydra-Slide. Front Slide, with Air-Gage Tracer, provides smooth, stepless cut for multiple diameters, tapers, faces, radii and chamfers with single-tool economy. One or more tools on rear unit neck, groove, form cut, and face. Both mounted on platen. Send coupon for complete story.

Monarch
TURNING MACHINES
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

Please send me your illustrated booklet #1703 on the new Monarch Hydra-Slide.

NAME_____ TITLE_____

COMPANY_____

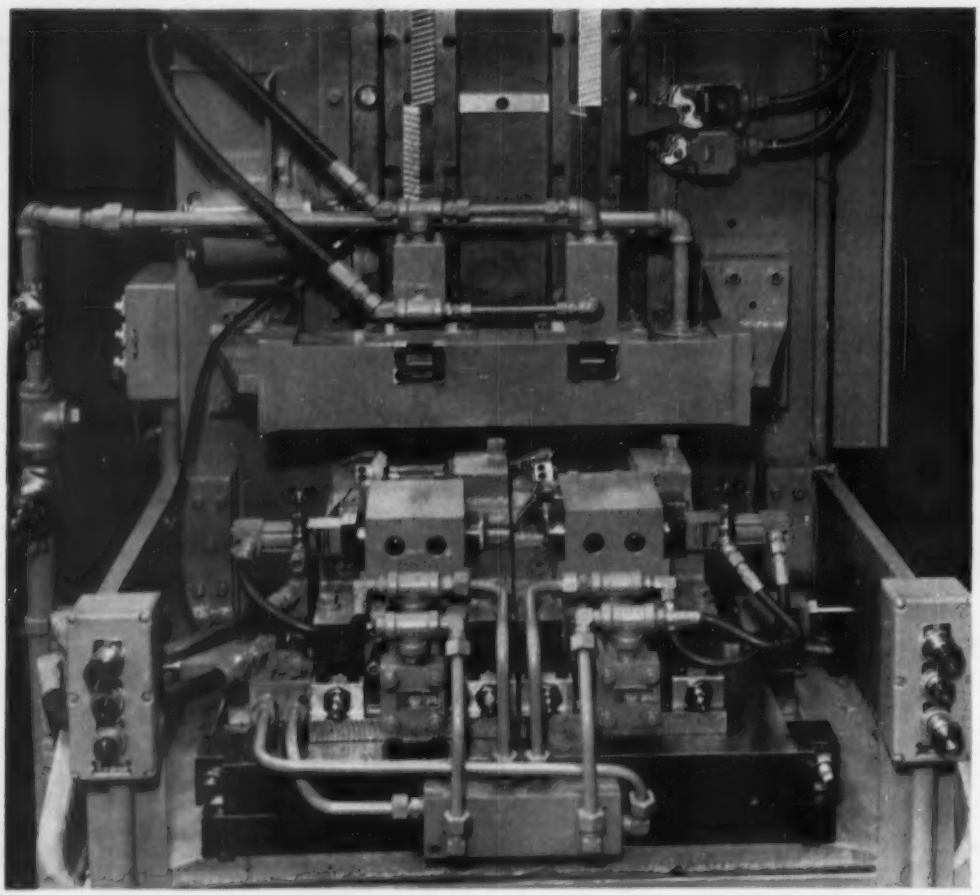
ADDRESS_____

CITY_____ ZONE_____ STATE_____

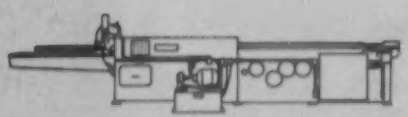
Although machining exceedingly tough material,

by converting to modern LAPOINTE

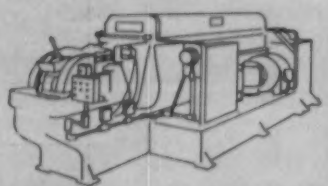
they easily doubled the former



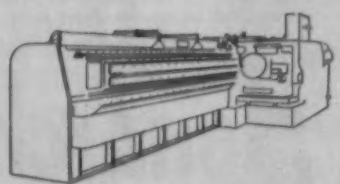
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



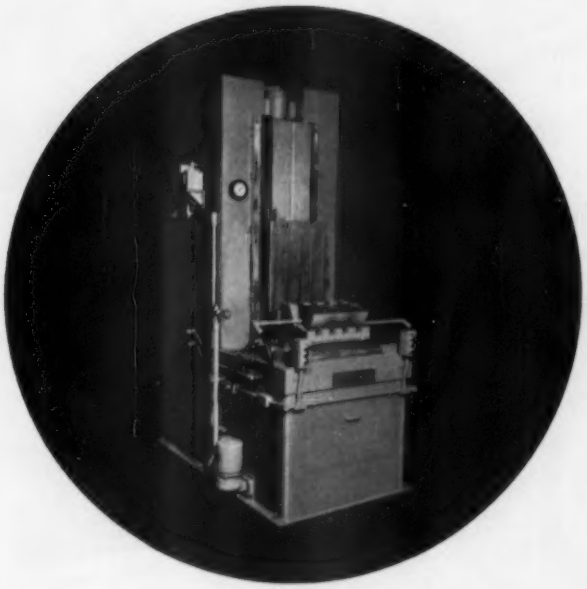
CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

-BROACHING

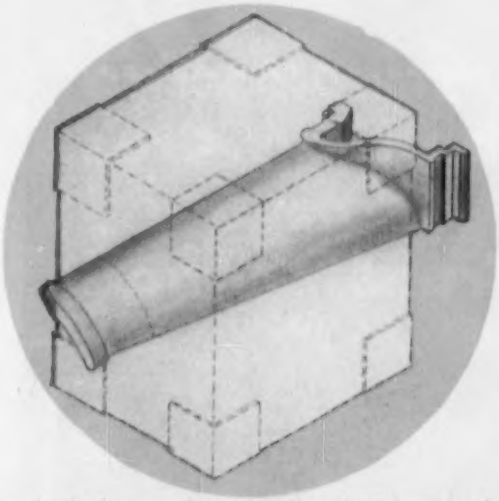
production rate!



The LAPOINTE 10-ton Single Ram Vertical Broaching Machine broaches these Turbine Vanes 2-at-a-time, removing .080" on each surface of the small buttress end. The part is cast in a shuttle block for holding, and location is taken off the block as well as the vane.

The fixture is the Lapointe-built In-and-Out type, having the entire top open for ease of loading and unloading.

This popular, versatile machine comes in ten sizes: 3- to 25-ton capacity, 30- to 90-inch stroke.



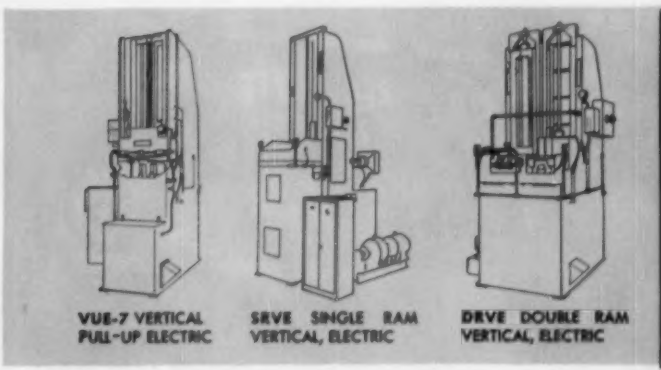
Everybody knows that Hastelloy "C" is one of the toughest alloys to work with . . . you don't exactly cut through it like a hot knife cuts through butter.

But here's a Turbine Vane, precision cast in Hastelloy "C", that is now being Lapointe-Broached on the buttress end at the rate of 192 parts per hour (at 80% efficiency) — using high speed steel Lapointe-made Broaches. They tell us that this is *twice* the production they were getting before converting to Lapointe-Broaching from their previous machining methods!

Maybe you've got a production problem in your shop, too . . . most everybody has. If so, it's just possible that a Lapointe Field Engineer could help you solve that problem! Why don't you invite him to talk with you about Lapointe-Broaching?

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS • U.S.A. In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



VUE-7 VERTICAL PULL-UP ELECTRIC

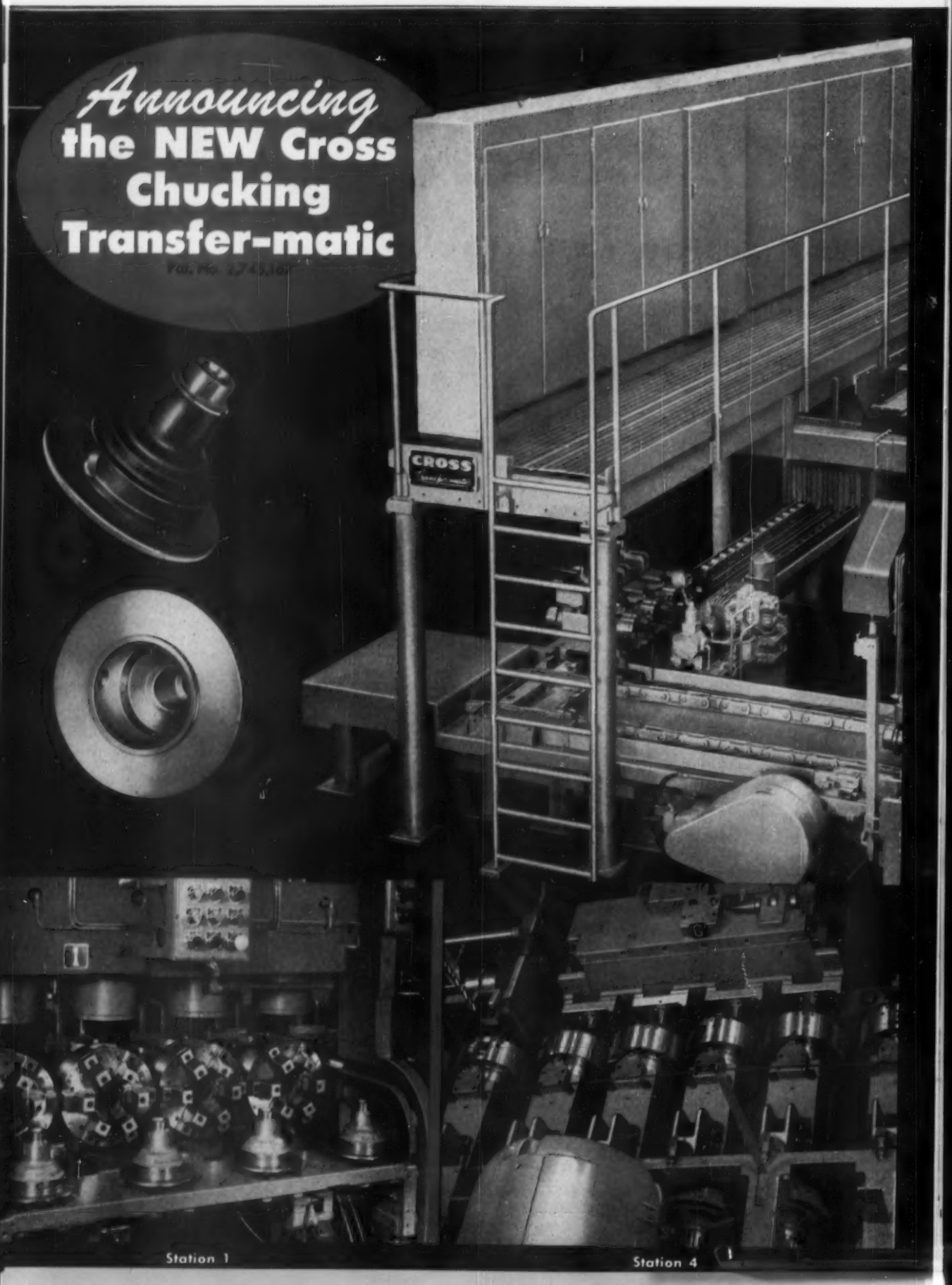
SRVE SINGLE RAM VERTICAL, ELECTRIC

DRVE DOUBLE RAM VERTICAL, ELECTRIC

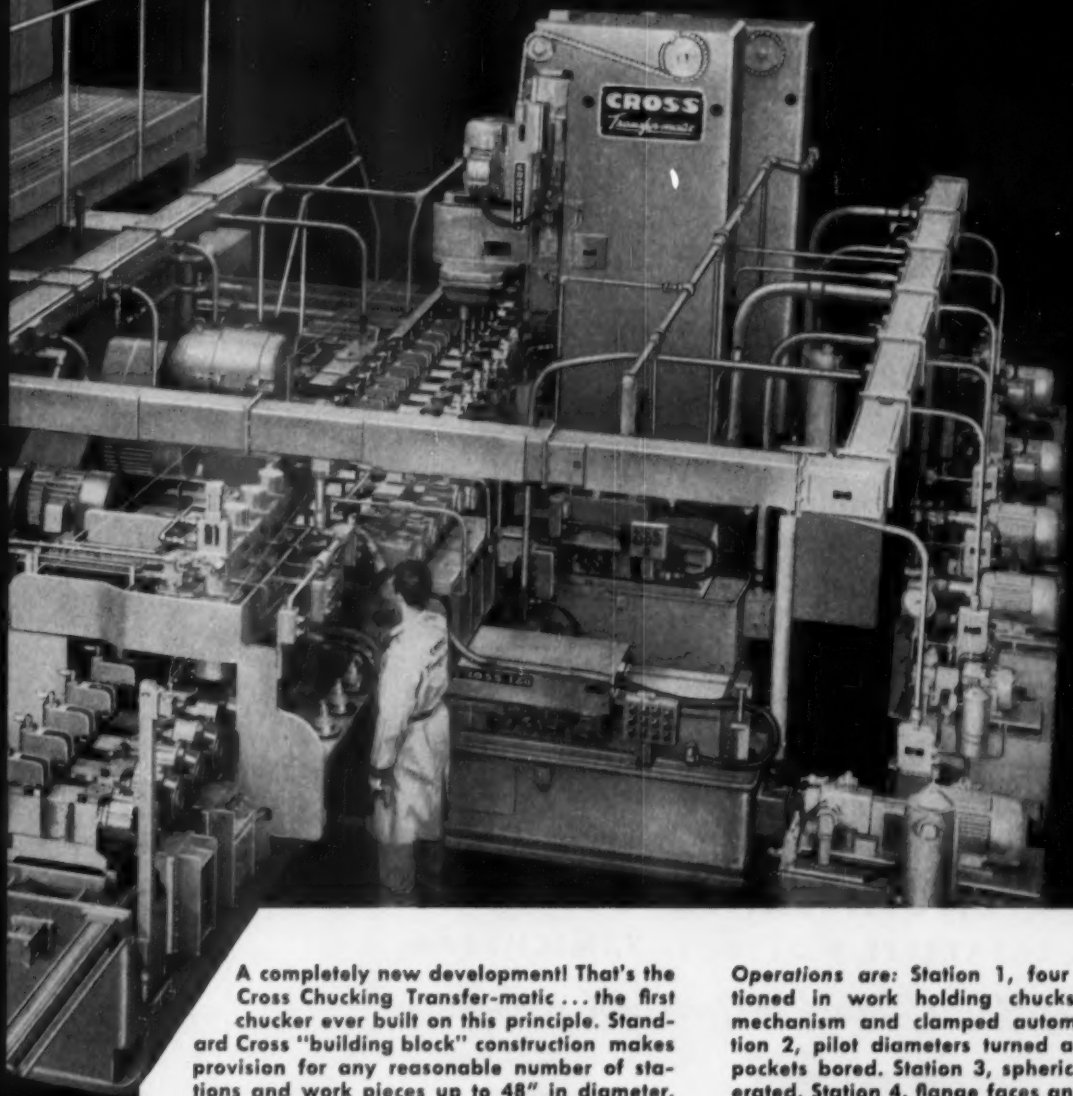
LAPOINTE

known to be the best in

BROACHING


Announcing
the NEW Cross
Chucking
Transfer-matic
Pat. No. 2,745,167
CROSS
Station 1
Station 4

Another Automation First by Cross



A completely new development! That's the Cross Chucking Transfer-matic . . . the first chucker ever built on this principle. Standard Cross "building block" construction makes provision for any reasonable number of stations and work pieces up to 48" in diameter.

This particular seven station Transfer-Matic, created for differential gear cases, has a rated capacity of 368 pieces per hour at 100% efficiency.

An unusual feature is that the work pieces are chucked and not released until all operations are complete. The chucks are mounted on precision spindles, which in turn are carried on pallets—four to the pallet. There are ten pallets—one at each station and three on the conveyor moving from Station 7 to Station 1.

Operations are: **Station 1, four pieces positioned in work holding chucks by loading mechanism and clamped automatically. Station 2, pilot diameters turned and side gear pockets bored. Station 3, spherical seats generated. Station 4, flange faces and thrust faces for side gears generated. Station 5, pin hole for pinion shaft drilled after spindles are indexed into pre-determined position and locked to prevent rotation. Station 6, pin hole chamfered top and bottom. Station 7, pin hole rough and finish reamed with shuttle head.**

Features include construction to JIC Standards, hardened and ground ways, interchangeability of all parts, pre-set tooling and programmed tool changes with the Cross Machine Control Unit.

Established 1898

THE **CROSS** CO.

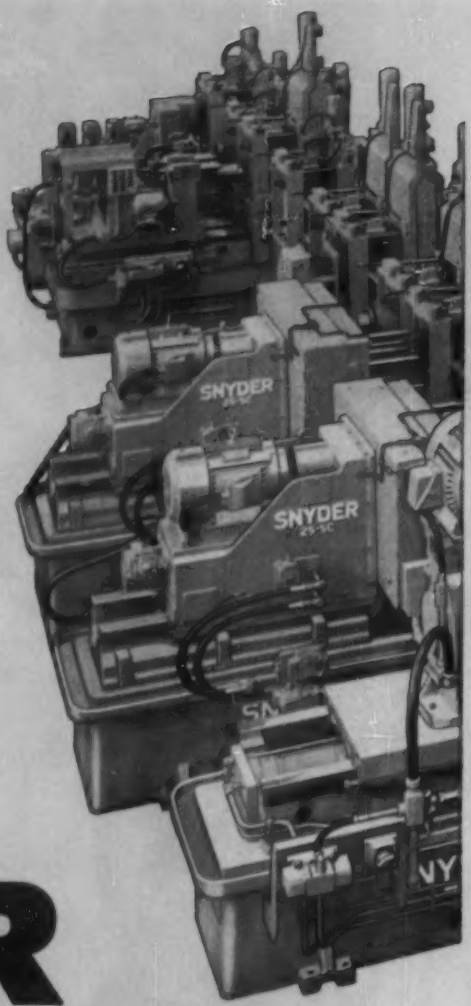
First in Automation

DETROIT 7, MICHIGAN

UNIQUE FEATURES IN SNYDER 9-SEGMENT, 24-STATION, IN-LINE AUTOMATED TRANSFER MACHINE

for processing converter housings; independent control panels permit individual segment operation (co-ordinated with master panel); electric circuits can be individually checked by Circuit-Sleuth Panel; at Station 4, workpiece is re-oriented 90°; at Station 21, two dowel holes and one transmission hole are precision bored to .001 in size; at Station 22 these holes are automatically precision air gaged.

Workpiece reaches machine finish ground on both faces; machine performs 59 operations, delivers workpiece completed and automatically inspected. Production, 128 pieces an hour at 100% efficiency.

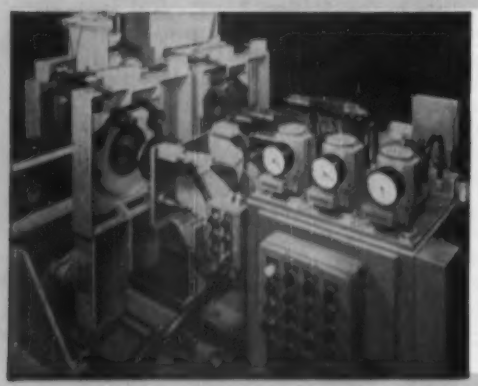


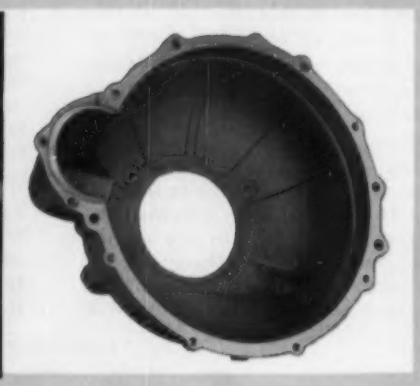
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

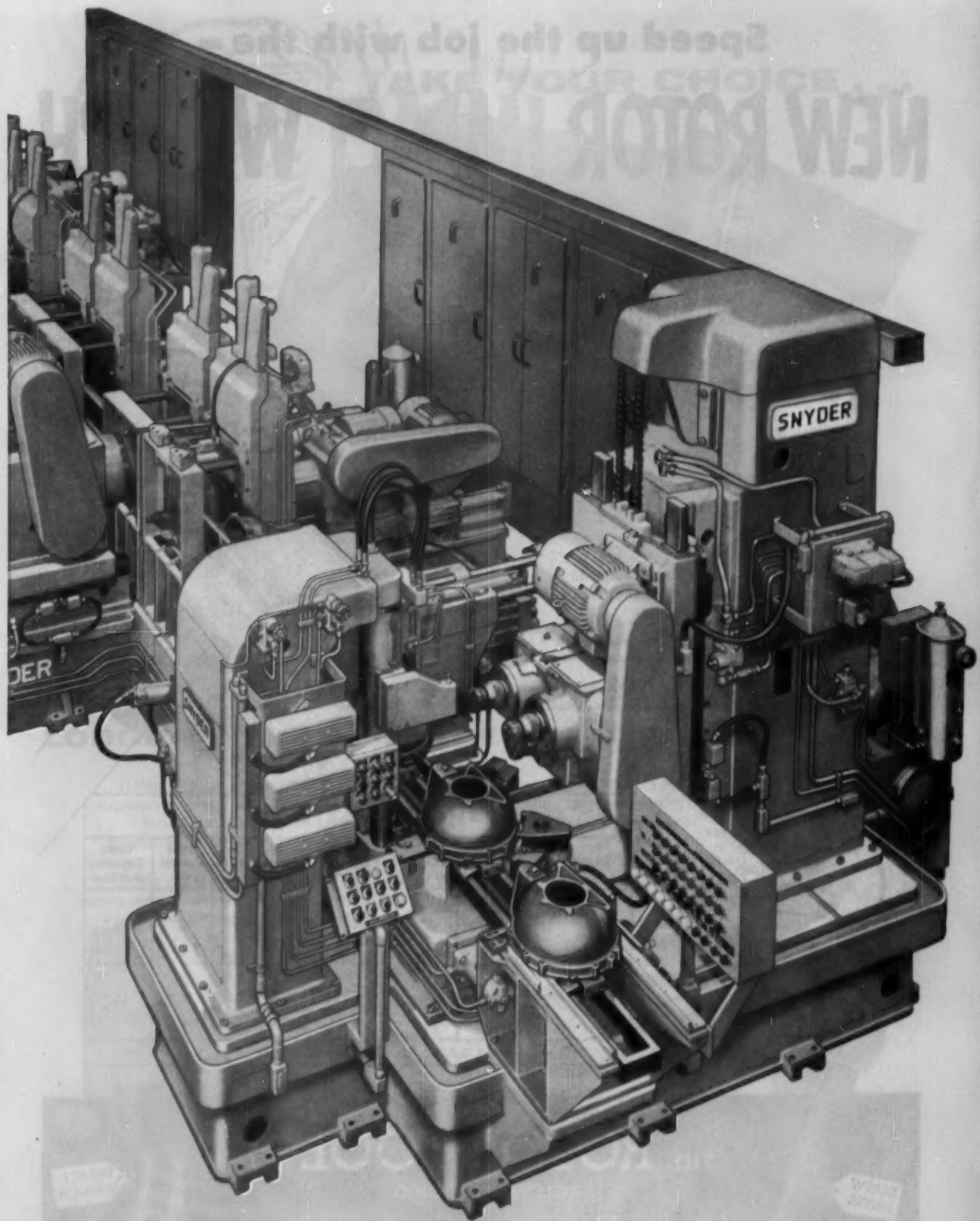
31 Years of Special Machine Tools with Automation





Boring and air gaging stations.

First in Automation
DETROIT 7, MICHIGAN



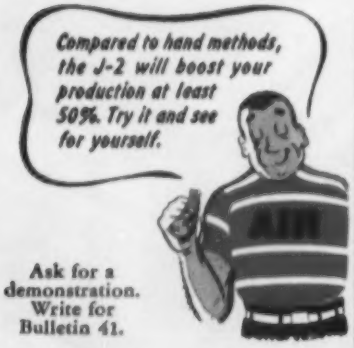
Speed up the job with the –

NEW ROTOR IMPACT WRENCH

FAST. Powerful air tool. 2100 solid blows per minute set nuts in a hurry. Reversible for removing nuts.

NON-FATIGUING. Weighs only 3 lbs. Well balanced. No stalling shock. No twist.

LOW MAINTENANCE. Fewer parts . . . some interchangeable . . . some reversible. Steel clutch housing. Rugged throughout.



Ask for a demonstration. Write for Bulletin 41.

SPECIFICATIONS

MODELS	Blows per Minute	Length	Weight	Square Drive*	Side to Center	Hose Connection	Rated Capacity, (Bolt Size)
J-2-S Side Handle	2100	6"	3#	½"	1⅛"	¼"	¼"
J-2-L Lever Handle	2100	7¾"	3¼#	½"	1⅛"	¼"	¼"

*⅜" square drive or ⅞" Quick-Change Chuck is optional.

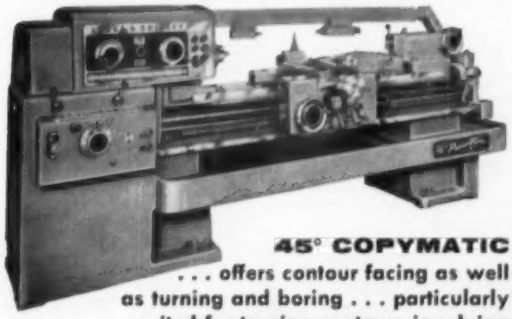
TAKE YOUR CHOICE . . .

45° OR 90° *Powerturn* COPYMATICS

LODGE & SHIPLEY TRACER CONTROLLED LATHES

Lodge & Shipley produces both these versatile duplicating lathes! Now, choose the type that perfectly suits your production. Speaking of production, these new lathes really produce at low cost. They combine proven advantages of all-hydraulic duplication . . . featuring either 45° or 90° tracing slide . . . with all the new POWERTURN features.

There are 5 new sizes and types of COPYMATICS suitable for your needs. Complete details are available in two new pieces of literature: Bulletin 309, 90° COPYMATIC and Bulletin 310, 45° COPYMATIC. For your copies, address: The Lodge & Shipley Company, 3055 Colerain Ave., Cincinnati 25, Ohio.



45° COPYMATIC
. . . offers contour facing as well as turning and boring . . . particularly suited for turning contours involving diameters connected to faces by curves!

90° COPYMATIC
. . . traces in both directions: toward head or tail . . . faces exactly square shoulders . . . maximum versatility and tracing capacity!

more than ever before . . .
your LODGE-*ical choice is* **Lodge & Shipley**

GENERAL ELECTRIC ANNOUNCES

static switching systems

General Electric's new static switching systems have been designed to increase significantly the dependability and life of control equipment where frequent operations, complex systems, and continuous processes are required or atmospheric problems exist.

These new G-E systems utilize static-magnetic and solid-state devices to perform a variety of control functions normally accomplished by contact-making devices. Static switching systems consist of varied combinations of seven basic units: an isolation switch unit, two multi-purpose units, a long time-delay unit, a short time-delay unit, an "AND" unit, and an "OR" unit. These units can also be combined with static power supplies, static amplifiers, and static regulators to provide completely static control systems.

Where frequent operations are involved, static switching systems are ideal, as they have no moving parts to wear.

Where complex control functions are required, the simplified circuitry of the static switching systems makes them particularly applicable.

For continuous processes, these systems assure dependability through the use of pre-tested, industry-proved static components.

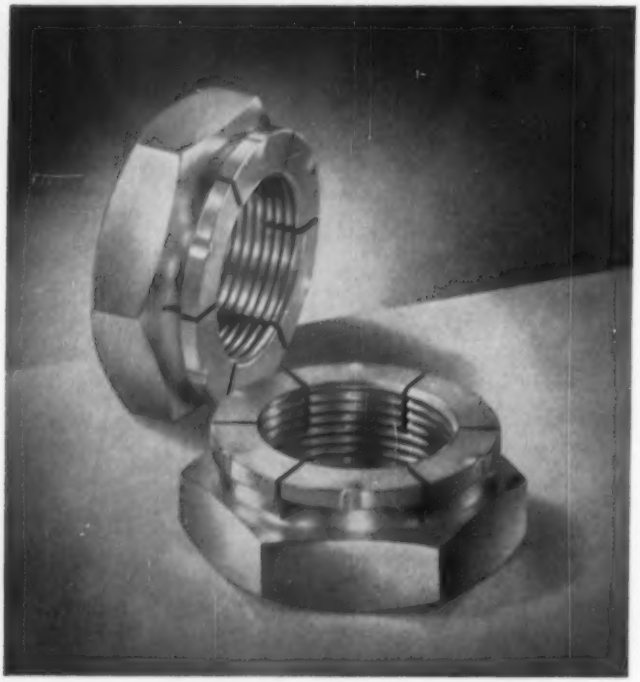
Unaffected by most atmospheric conditions, the static units are encapsulated in an inert, lightweight compound.

General Electric control engineers are ready now to help you apply the benefits of static switching systems to your machines or processes. For additional information, contact your nearest General Electric Apparatus Sales Office, or write for Bulletin GEA-6364 to Sect. 785-2, General Electric Co., Schenectady 5, New York. *Industry Control Dept., Roanoke, Virginia.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

Flexloc thin nuts save space, weight and production time



Self-locking nuts are 30% lower and lighter; speed up assembly with hand or power tools

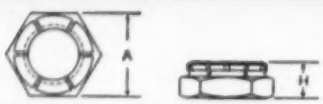
Self-locking FLEXLOC thin nuts are 30% lower than regular height locknuts of the same nominal diameter. They fit into spaces where regular height locknuts will not go. You can design lighter, more compact units with them.

Where you must reduce weight in a completed assembly, you can save by using shorter bolts with these lighter nuts. And you save production time. The length of engagement of mating threads is shorter: fewer revolutions of hand wrenches or power nut runners are needed to seat them.

FLEXLOC nuts are of 1-piece, all-metal construction. You can use a FLEXLOC fully seated as a locknut or at any point along a bolt as a stop nut. Once the threads in the resilient locking section are fully engaged, the FLEXLOC grips the mating threads with uniform locking torque wherever wrenching stops. Since there are no nonmetallic inserts to come out or deteriorate, the locking life of a FLEXLOC is virtually unlimited.

Your authorized industrial distributor stocks FLEXLOC nuts in a variety of sizes, materials and finishes. Consult him for details. Or write us for information about your special locknut problem. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

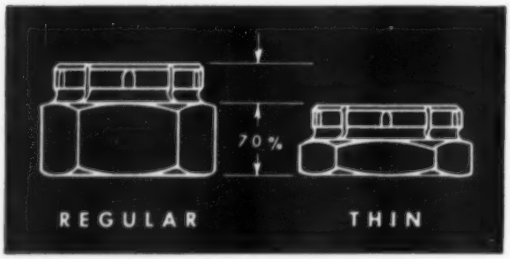
SPECIFICATIONS
FLEXLOC THIN NUTS



NATIONAL COARSE THREAD—U.S.S

SIZE	A INCHES	H INCHES	WIDTH ACROSS CORNERS	WEIGHT PER 1000 NUTS
6-32	.312	.125	.361	1.8
8-32	.344	.172	.397	2.8
10-24	.375	.172	.433	3.3
¼-20	.438	.203	.505	5.4
5/16-18	.563	.250	.649	11.6
3/8-16	.625	.265	.722	14.9
7/16-14	.750	.312	.866	24.9
½-13	.813	.312	.938	28.4
9/16-12	.875	.359	1.010	36.1
5/8-11	1.000	.391	1.155	54.1
3/4-10	1.125	.406	1.299	69.2
7/8-9	1.312	.469	1.516	107.5
1-8	1.500	.563	1.732	171.6
NATIONAL FINE THREAD—S.A.E.				
6-40	.312	.125	.361	1.8
8-36	.344	.172	.397	2.8
10-32	.375	.172	.433	3.3
¼-28	.438	.203	.505	5.4
5/16-24	.500	.250	.577	8.7
3/8-24	.563	.266	.649	11.5
7/16-20	.625	.312	.722	14.9
½-20	.750	.312	.866	21.7
9/16-18	.875	.359	1.010	36.2
5/8-18	.938	.391	1.082	42.4
3/4-16	1.063	.406	1.227	54.5
7/8-14	1.250	.469	1.443	84.6
1-14	1.438	.563	1.660	136.3
1 1/16-12*	1.625	.625	1.876	193.5
1 1/8-12*	1.813	.750	2.093	296.0
1 3/16-12*	2.000	.812	2.309	389.0
1 1/4-12*	2.187	.875	2.526	498.0

*Steel only (plain or cadmium plated) in stock sizes.



FLEXLOC thin nuts are 30% lower than regular height locknuts. There is a corresponding saving in weight. In sizes through 5/16 in., thin FLEXLOCS meet tensile strength requirements for regular height locknuts. FLEXLOC nuts can be made in the thin type because every thread, even those in the locking section, carries its full share of the load. There are no nonmetallic inserts to waste head space or weaken the structure of the nut.

Standard FLEXLOC self-locking thin nuts are available in plain or cadmium plated alloy steel, for use in temperatures to 550°F; in plain or silver plated corrosion resisting steel, for temperatures to 750°F; and in brass and aluminum, for temperatures to 250°F.

STANDARD PRESSED STEEL CO.
FLEXLOC LOCKNUT DIVISION SPS
JENKINTOWN PENNSYLVANIA

Goodbye ~~ME~~ Chips!

ROLL Splines the MODERN way with the LEES-BRADNER MANUFACTURED, (GROB PROCESS)

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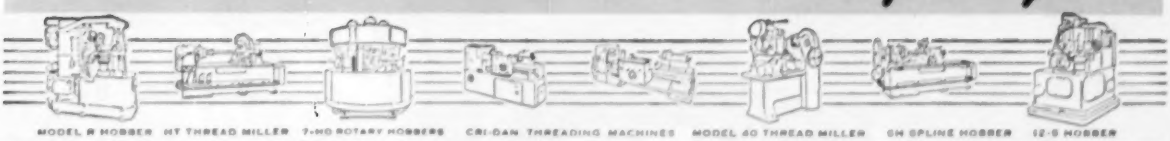

MODEL R HOBBER · HT THREAD MILLER · 7-HD ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · 5H SPLINE HOBBER · 12-S HOBBER

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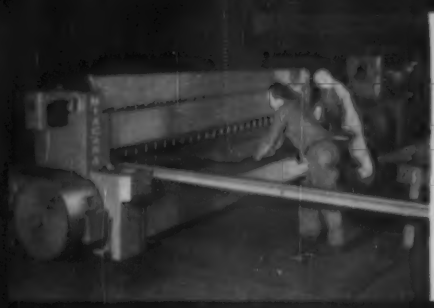
SHEAR USERS EVERYWHERE TELL THEIR STORIES OF NIAGARA BENEFITS

(3 of 19 Photo-Reports shown in Niagara's new Bulletin 69G)



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— World's Largest Trailer Mfr.

"For over 10 years we have never had any downtime for repairs and maintenance."
— V-Belt Pulley and Caster Mfr.

"High quality of accuracy with the utmost in speed and performance"
— Midwest Road Machinery Mfr.

squaring shears can do for you!

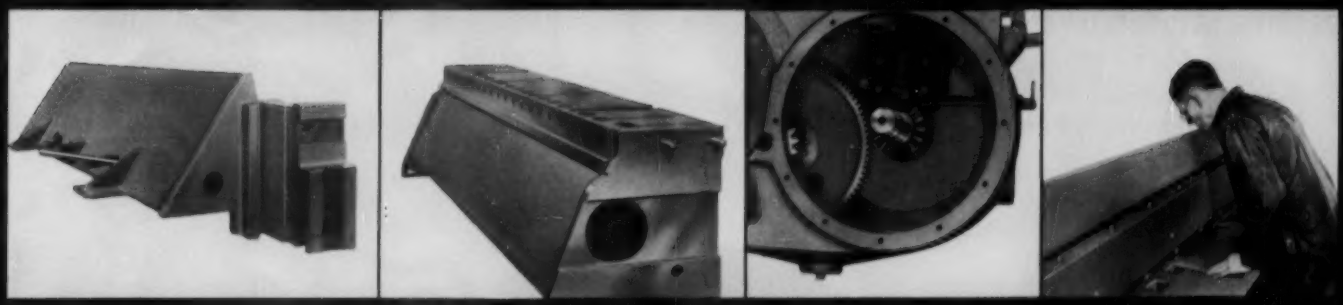
Speed that spells peak productivity! Accuracy for cutting within micrometer tolerances! Ruggedness to stand the gaff on stiffest assignments! They're all yours with a Niagara Power Squaring Shear. New, fact-filled 74-page Bulletin is profusely illustrated to show you how and why:

From mass producers, fabricating plants, steel warehouses and sheet metal shops comes written evidence of the superiority of Niagara Underdrive Squaring Shears on jobs of every description. *No other shear can match Niagara's record for cutting accuracy, speed and downright economy of operation.*

For a photo story of the many tangible ways in which a Niagara Power Squaring Shear can boost hourly output, improve quality and slice maintenance costs in your plant, make sure that you receive Niagara's newly-published Bulletin 69G by mailing the coupon below. Presenting the greatest shear story ever told this 74-page document will give you a close look at Niagara Shears in numerous applications . . . the *closest* look you have ever had at *any* shear, next to having it on your own floor! It will show you feature-by-feature why a Niagara Shear is far ahead at every point of comparison . . . and why it pays to look to America's oldest leading shear manufacturer for the most profitable answers to *your* requirements.

NIAGARA-DEVELOPED FEATURES PROVIDE THE ULTIMATE IN MODERN SHEAR PERFORMANCE

(Here's a glimpse at just a few of many. See them ALL in new Niagara Bulletin 69G)



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Massive Bed Designed for Super Strength

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YOURS FOR THE ASKING...

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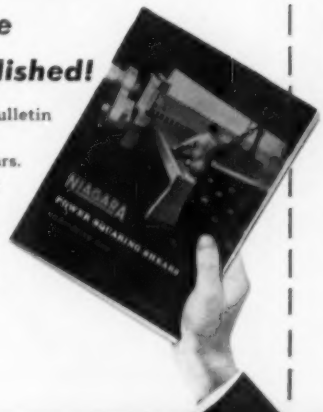
Months in preparation, this fact-filled bulletin now gives you valid, inside facts on the nation's top line of power squaring shears. 74 pages! 141 revealing photographs and illustrations! Specifications for nearly five dozen standard models! Capacities: 16-gage to 1" mild steel. Cutting lengths: 4 to 20 ft. Make sure that you receive a copy at once. Mail the attached coupon today.



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MAIL your new Underdrive Squaring Shear Bulletin 69G to us immediately.

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For all their Christmases give them a world of brighter tomorrows

MORSE TWIST DRILL &
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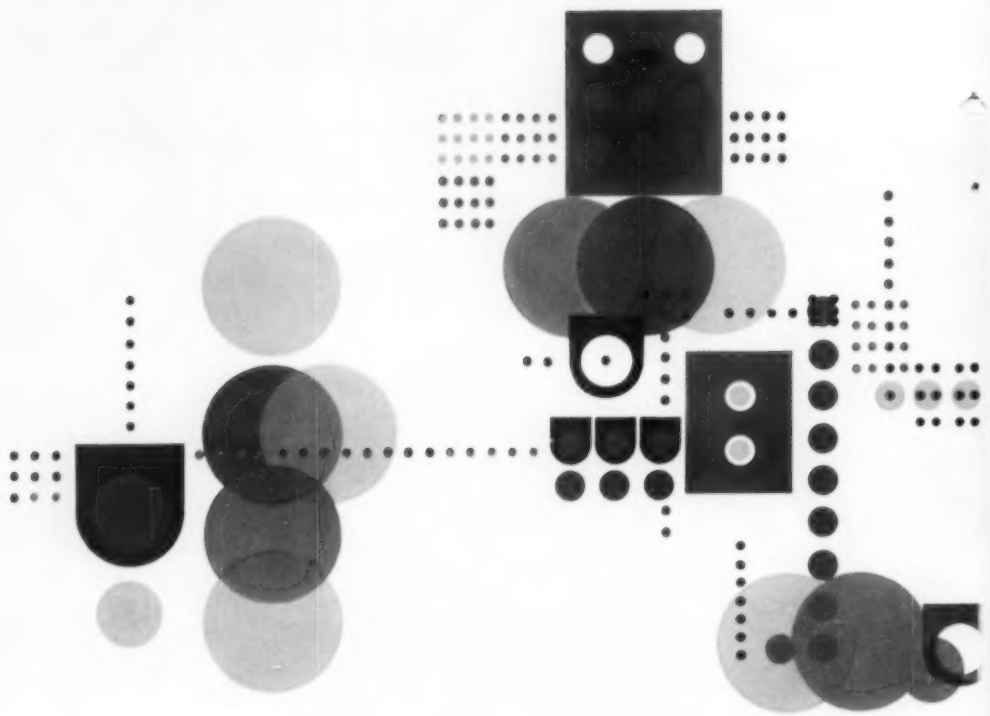
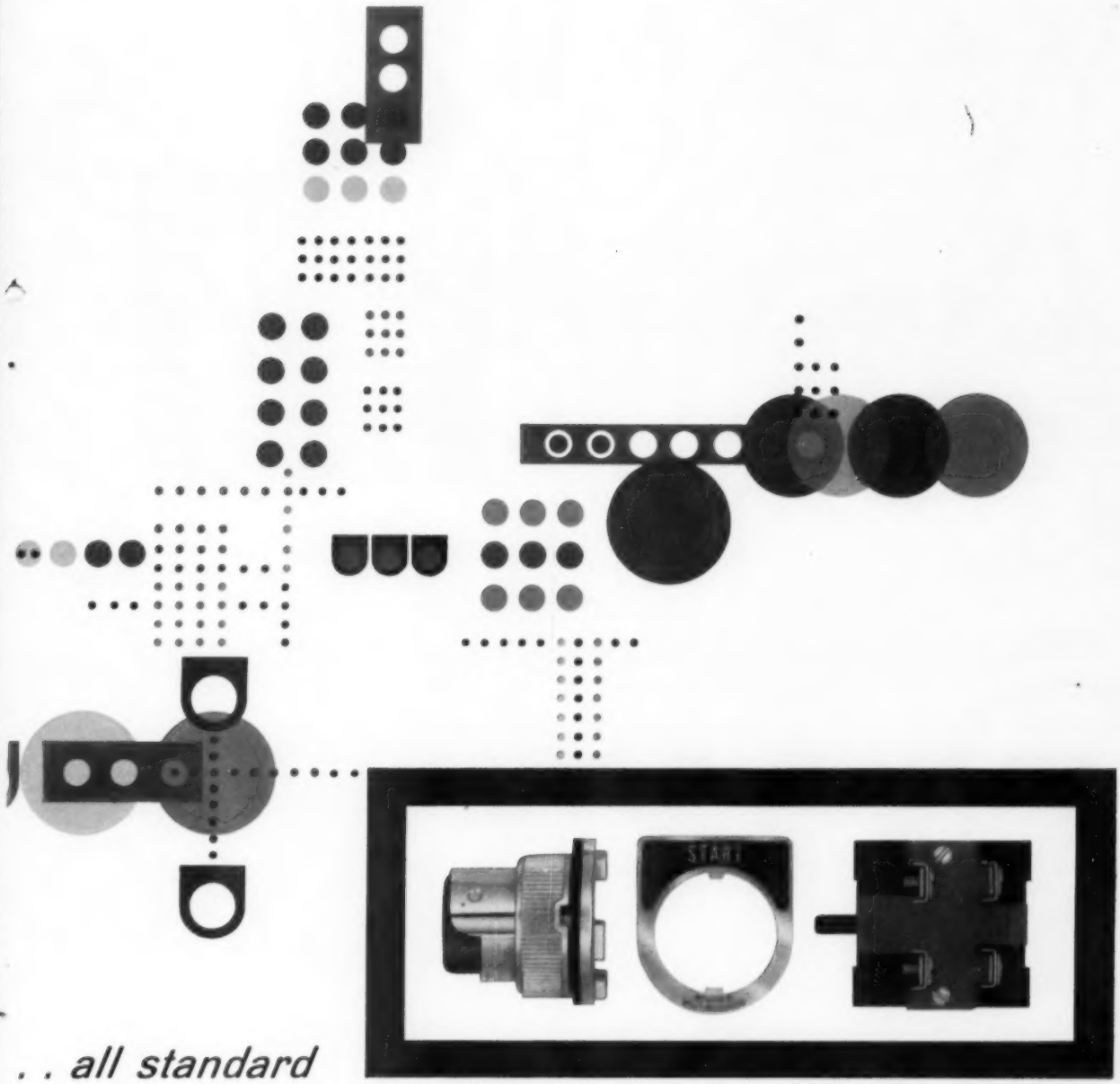
Subsidiary of Van Norman Industries, Inc.

NEW BEDFORD, MASSACHUSETTS



Pushbutton control arrangements almost to infinity . . .



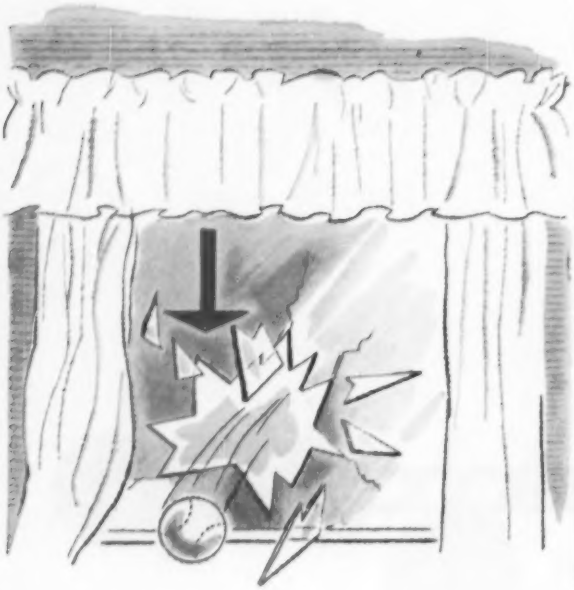
. . all standard

How'd you like a stock of 1,500,000 pushbutton controls on hand at all times for original equipment needs or for production purposes?
Sound prohibitive space-wise, or too expensive? Not at all. Just 38 Westinghouse components (shown above) do it because all parts are standardized and interchangeable. And always available from stock.
If you need controls for any application, write for the free 72-page *Pushbutton Guide*, B-6749. For control where moisture is a problem, write for free Booklet, B-7022, about Oil-Tite* controls. Write to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. Or call your Westinghouse Distributor.
*T. M.

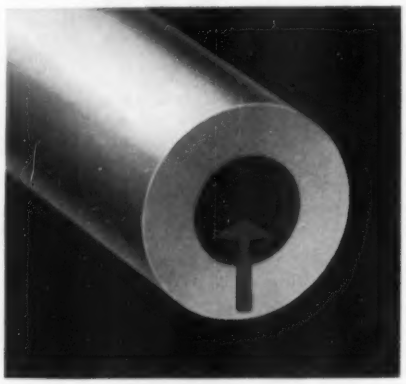
J-30248

YOU CAN BE SURE... IF IT'S

Westinghouse



a hole here means work...



a hole here saves work

Crucible Hollow Tool Steel Bars take much of the work out of making ring-shaped steel parts, or tools with a center hole. The hole's already there. You save expensive drilling, boring, cutting-off and rough-facing operations . . . you reduce machine time and scrap losses.

You can now get Crucible Hollow Tool Steel Bars in any of the famous Crucible tool steel grades, in virtually any I.D. and O.D. combination. And you can get *immediate delivery* from stock of the five most useful grades — KETOS oil-hardening . . . SANDERSON water-hardening . . . AIRDI 150 high-carbon, high-chromium . . . AIRKOOL air-hardening . . . NU DIE V hot-work tool steels.

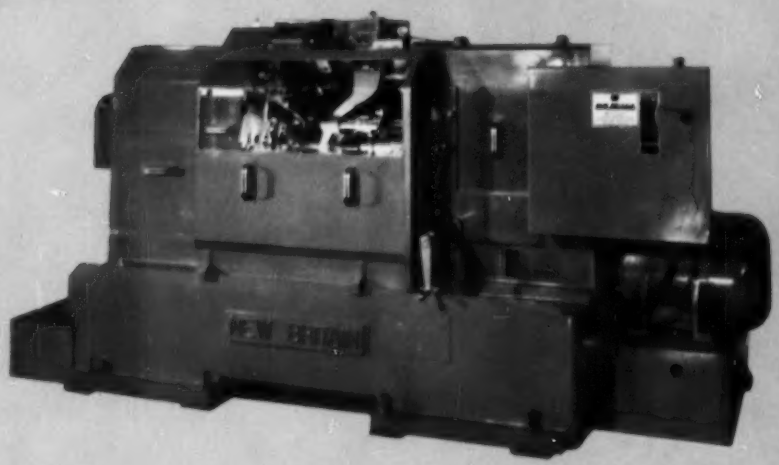
Your Crucible representative can quickly show you how Crucible Hollow Tool Steel Bars will save you work and money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

WHEREVER YOU TURN
on multi-spindle bar machines
NEW BRITAIN HAS THE MACHINE FOR YOU

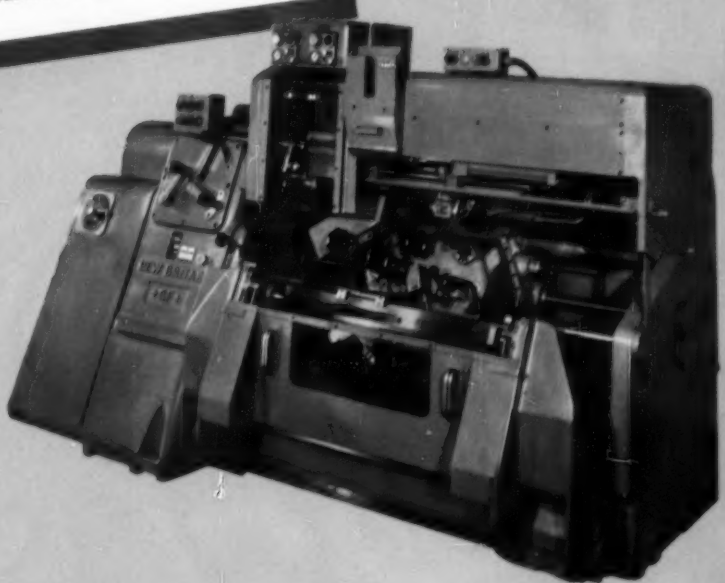
THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB



The new Model 62 New Britain bar machine has an independent radial cross slide in every position — opening new possibilities for effective tooling. New Britain "accuracy features" include spindle carrier lifting to eliminate wear during index, plus rigid locking of the carrier during the cutting cycle. Magazine loading available if desired.

WHEREVER YOU TURN
long or short runs
NEW BRITAIN HAS THE MACHINE FOR YOU

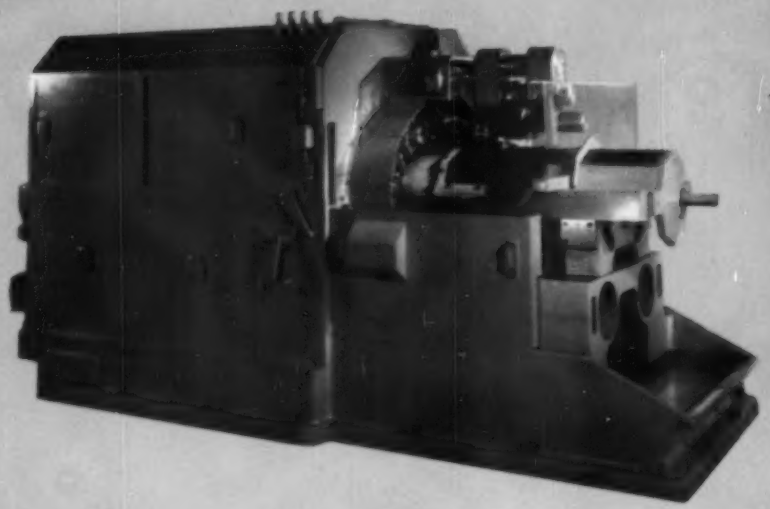
THE NEW BRITAIN MACHINE CO.
Model 11/70
New Britain +GF+
Copying Lathe
NB



The original New Britain **+GF+** copying lathe has grown into an extensive line, to meet the demand for the wide variety of applications for its better copy-turning principle. Regardless of length of run or the variety of pieces you make, you can use the New Britain **+GF+** profitably. Basic advantages are: fast setup, inexpensive tooling, elimination of the chip problem, minimum operator fatigue, and dimensional accuracy with good surface finish to reduce grinding allowances. Optional features include automatic re-cycling, automatic loading and ejecting.

WHEREVER YOU TURN
castings, forgings or pressed metal pieces
NEW BRITAIN HAS THE MACHINE FOR YOU

THE NEW BRITAIN MACHINE CO.
Model 810
Automatic
Chucking Machine
NB



Versatility, accessibility, quick setup and sustained high production of precision parts are what you look for in an automatic chucker. New Britains are famous for these features all over the world. Perhaps you are also thinking of the possible savings which automatic loading, unloading and automatic gauging could effect. If so, you will want to learn about the imaginative use of automated production which New Britain engineers are applying to chucker work these days. You can now handle bigger pieces than ever on New Britains too — up to fifteen inches in diameter.

WHEREVER YOU TURN
or bore precision contour work
NEW BRITAIN HAS THE MACHINE FOR YOU

THE NEW BRITAIN MACHINE CO.
Model 37
Precision Boring
Machine
NB

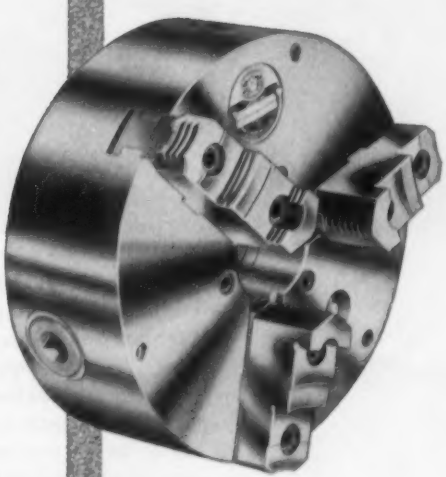
New Britain precision straight and contour boring machines provide a new approach to machining parts that would be problem pieces on any other type of equipment. These simple, fast, accurate machines require minimum attention and utilize inexpensive single point tools. They make the most profitable use of automatic loading, gauging and tool adjustment where these features fit the job requirements. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

the finest precision lathes

Photo courtesy Hendey Div., Barber-Colman Co.

This is the NEW Hendey 32-Speed Geared Head Lathe which represents the finest in accuracy and production, in keeping with Hendey's long-standing reputation for the finest in lathes. Write the Hendey Div., Barber-Colman Co., Rockford, Ill., for complete information on this outstanding new lathe.

deserve the finest precision chucks

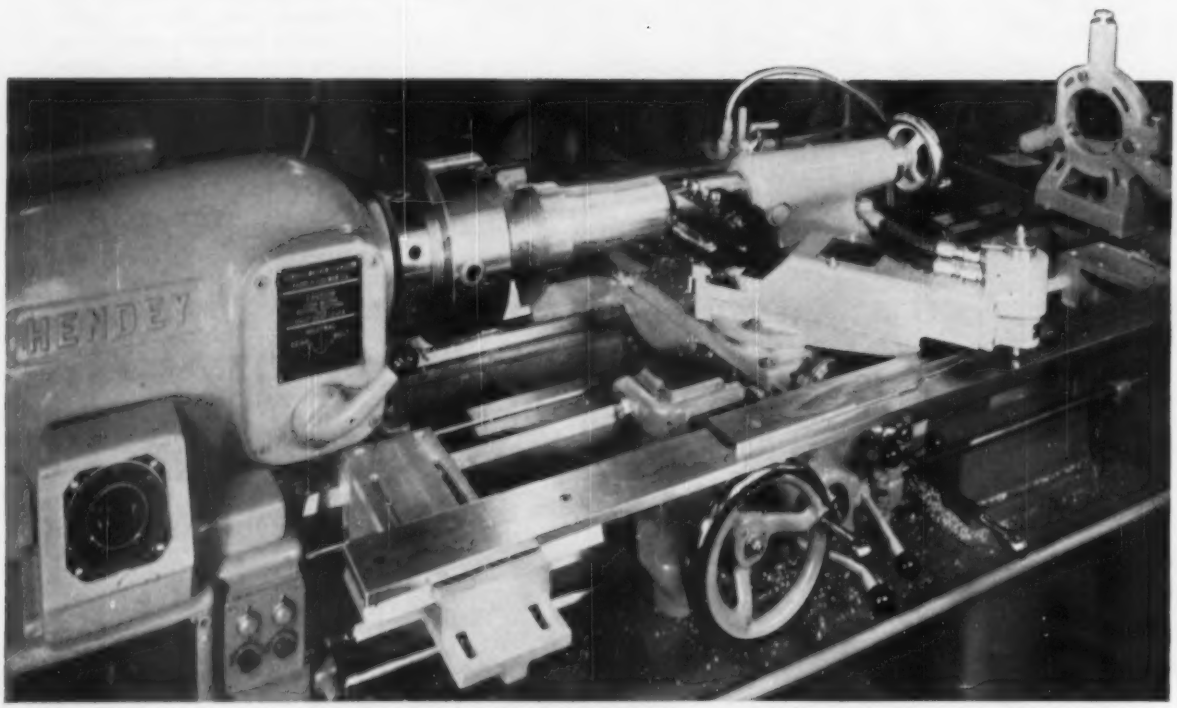


This is Horton's standard 3-Jaw Scroll Universal Chuck which has contributed to Horton's reputation for chuck leadership for over 100 years. Its precision and lasting accuracy make it a must in any production picture. For the complete story on the complete line of Horton Chuck, see the Horton people in your area now.

HORTON CHUCK
Since 1851

WINDSOR LOCKS, CONN.

new tracer control TO *Hendey* NO. 2E

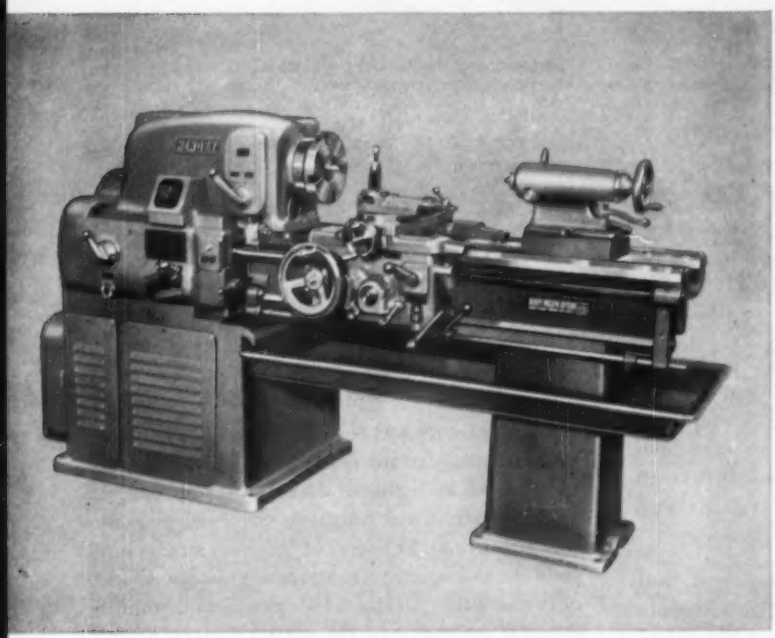


Already known as the multi-feature lathe, the Hendey No. 2E now offers a hydraulic tracer for production turning jobs. Available as optional equipment, the packaged-unit tracer attachment doesn't require drilling any holes for mounting, it simply replaces the standard compound. Mounting brackets for holding the flat template are fastened quickly with two bolts. Whenever three or more pieces are to be step-turned, a tracer-equipped Hendey No. 2E can do the job with unmatched economy and requires only a few minutes' setup time. The close tolerances and fine finishes you get reduce, or in many cases eliminate, additional finishing operations.

This tracer-controlled lathe with infinitely variable speed is in the moderate price class. Contact your Hendey dealer for details and specifications.

ADDS EARNING POWER

GENERAL PURPOSE LATHE



Right Turning Speed for Every Job

Hendey stepless speed control makes an ideal combination with the hydraulic tracer . . . fingertip control permits smooth speed changes even while spindle is under load . . . dynamic braking means faster stopping and reversing of spindle . . . all design features are tailored to give you lowest cost per piece produced with a minimum capital investment.

General Purpose Lathe No. 2E, 14 in.

With tracer removed you have an outstanding general purpose lathe for precision turning in toolroom or shop . . . spindle speeds infinitely variable from 15 to 1500 rpm . . . belt drive for smooth, vibration-free performance . . . preloaded precision spindle bearings insure accuracy . . . alloy cast iron bed ways induction-hardened and ground for long life.

for precision with production, buy Hendey

Hendey machine division
BARBER-COLMAN COMPANY
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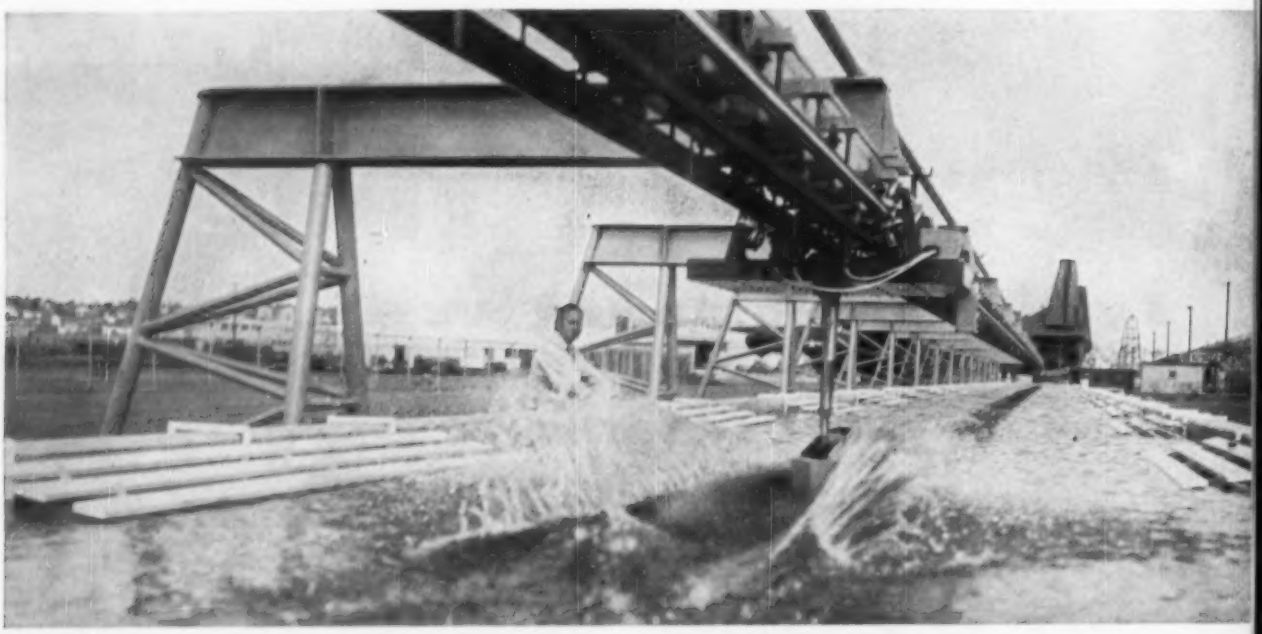
BARBER COLMAN



Above photo shows spray pattern as model hull slices through the water. Data recording devices travel with the model over stainless steel rails. High-speed motion picture cameras record hull performance through heavy plate glass windows in sides and bottom of tank.

New use for Stainless Steel developed by Convair in testing seaplane hull models

Stainless steel bars are playing an important part in testing hulls for advanced-type seaplanes at Convair's new 300-foot model seaplane towing tank, first unit of a proposed $800,000 hydrodynamic laboratory. Convair is a Division of General Dynamics Corporation.

Testing is conducted by suspending a hull model from a carriage which runs on a double overhead rail. The rails are 1¼"-dia. cold finished stainless steel bars. Carriage rollers which run on the bars are also stainless steel. The rails are suspended three feet over the water level on "I" beams and tubular steel framework towers.

Stainless steel was selected for this application because of its extremely high resistance to corrosion, wear and abrasion—resulting in ease of maintenance. Cold finishing the bars provides the additional benefits of higher tensile and yield strength, close tolerance, uniform soundness and a fine surface finish permitting smooth, accurate operation of the testing device.

Stainless steel is the aircraft metal of many uses. It has literally thousands of both ground and air applications. Its exceptionally high

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

Seaplane hull model is poised for run down 300-foot long towing tank. When complete, entire facility will be 700 feet in length and will be enclosed in a windproof structure to prevent gusts and inclement weather from interfering with tests.

strength-to-weight ratio permits the use of thinner, lighter sections. Use it to gain space or save weight without any sacrifice in strength or safety. Or use it to resist heat, corrosion and abrasion.

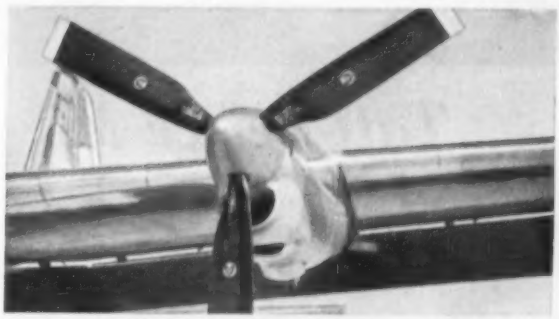
Republic—world's largest producer of aircraft steels—supplies ENDURO Stainless Steel in all commercial forms including hot rolled and cold finished bars, forging stock, plates, sheets, strip and wire. Republic metallurgists and engineers are ready to help you apply stainless steel to your present and future development work. There's no obligation. Just mail the coupon.

STEEL

and Steel Products

ANOTHER NEW USE FOR STAINLESS STEEL was created with the advent of the turboprop engine. Tank trucks used in refueling turboprops consist of two separate compartments. One is fabricated from Republic ENDURO Stainless Steel to resist the corrosive effect of the alcohol-water mixture. The other, for kerosene, is made from Republic 50 High Strength Steel for lightness and strength. The compartments are then welded together into one strong unit.

NEWCOMER AMONG AIRCRAFT METALS—TITANIUM saves weight and cuts cost in Navy helicopter. Use of .016 gage Republic Titanium, Type RS-70, Annealed, for firewall sections between pilot and engine compartments has resulted in substantial savings in weight and production costs. This type has good forming qualities and a minimum tensile strength of 80,000 psi. Republic melts and rolls titanium in all forms.



NEW EXTRUSION PROCESS AND ALLOY STEEL combine to provide greater strength and resistance to fatigue with minimum weight in turboprop propeller blades. The extruded blade, produced by the controlled extrusion process developed by Curtiss-Wright, starts as a single-piece billet of Republic Alloy Steel. The outstanding qualities of Republic Alloy Steel together with the extrusion process have resulted in a superior blade and increased production with reduced cost.

REPUBLIC STEEL CORPORATION
Dept. C-2388
3102 East 45th Street
Cleveland 27, Ohio

Please send more information on:
☐ ENDURO® Stainless Steel
☐ High Strength Steel
☐ Have a metallurgist call.
☐ Titanium
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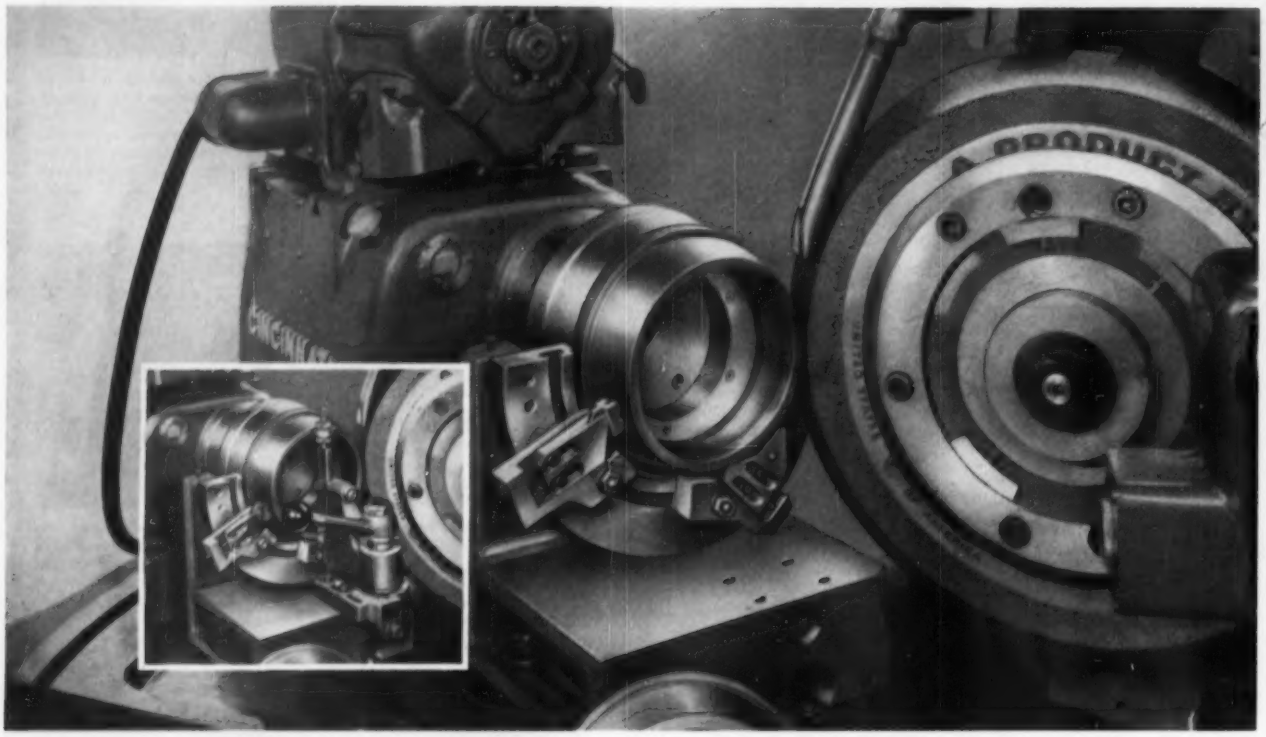
Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

New Tricks for Machining with



Taft-Peirce Magnetic Work Drivers

Two-pole Taft-Peirce Permanent Magnet Work Driver. Magnetically holds ball bearing inner races during grinding of external ball grooves. Parts are shown in front of work driver.

This Latest Application of Magnetic Forces by Taft-Peirce provides a Real Tooling Setup at great savings!

Here's a complete tooling setup for minimum cost! Magnetic Work Drivers eliminate awkward tailstock arrangement, cost substantially less than complicated holding devices. Little or no maintenance is required, there's nothing to go wrong. Developed primarily for shoe type centerless grinding of ball bearing, inner and outer races, the T-P Work Driver can hold a variety of sizes and shapes, including tapered OD for governing valve plugs and OD and ID of valve ports. Work Drivers can be designed to handle work from ½" ID and larger. Furnished in either permanent magnet or in electromagnetic models, Work Drivers are specially designed and built for each application.

The Taft-Peirce Family

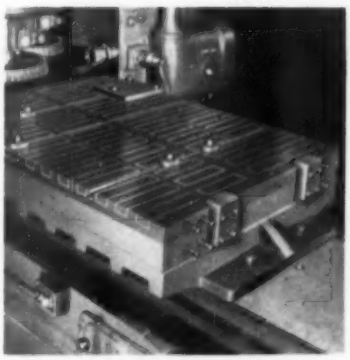
AIR GAGES • LAPPING MACHINES • PRECISION GAGES
TOOL-ROOM SPECIALTIES • MAGNETIC CHUCKS • GRINDING MACHINES

Magnetic Work Drivers and Chucks

Superpower Rotary Electromagnetic Chucks

Taft-Peirce packs maximum holding power in a small space so that simplified, low-cost setups can be used on rotating spindles. This small Rotary Chuck is grinding close to a shoulder, without complicated fixtures. There are ten standard sizes with diameters from 5⅛″ to 30½″, to give the most effective holding power for the work being done. Special faceplates can also be designed.

Superpower Specials Do Wide Variety of Work

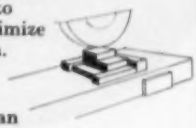


The speed and simplicity of magnetic chuck-held machining is providing lower-cost production on an ever greater range of work. The special 55½″ x 40″ Superpower Chuck at right was built to hold cast iron loom-sides on a 75 hp milling machine. Three 18″ carbide cutters and two 4″ mills take ¼″ cuts simultaneously at 30″ per minute. Taft-Peirce Chucks have been built to handle light planing and milling and special shapes, including holding propeller blades for shaping and contour grinding. If there is any possibility magnetic chucks can help your production, give the problem to Taft-Peirce for further study.

Tips

and IDEAS on MAGNETIC CHUCKING

Permanent Magnetic Chucks should always be faced with the pack (handle) moved to the "off" position. This assures minimum deflection of the faceplate. Electromagnetic Chucks should be turned "on" and allowed to "warm-up" to minimize faceplate distortion.



Magnetic chucks can be used to hold non-ferrous materials by "backing-up" or surrounding the workpiece with bars or pieces of steel.

Irregular shaped parts can be easily ground using the "mold" technique. Invert part, surround with a mold of lead, babbit or sulphur incorporating steel slugs near the top of the mold. Then, turn right side up, place on chuck and grind.

Get the Taft-Peirce Catalog on Chucks

Catalog No. 412 presents technical data, design details, suggestions and prices on the complete Taft-Peirce line. Find out what magnetic chucking can do for *your* production by writing: The Taft-Peirce Manufacturing Co., Woonsocket, Rhode Island.

T-P

TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO.
WOONSOCKET, R. I.

T-P Means TOP Precision

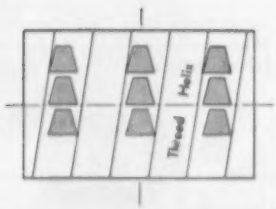
BARBER-COLMAN offers

thread milling requires accurate cutter design!

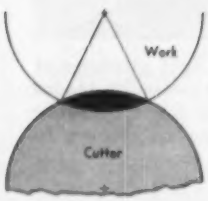
mathematical computation of cutter form

Multiple thread milling cutters often produce a thread space form which is not a duplicate of the cutter tooth form. The cutter tooth form is not a duplicate because the cutter tooth rotates in a plane which is perpendicular to the work axis and at an angle to the thread helix. This generating action produces a fillet at the bottom of the threads, and a thread space which is wider than the cutter tooth. When the amount of generating produces an unsatisfactory thread form, the cutter must be developed to produce the desired thread tooth thickness without fillet interference.

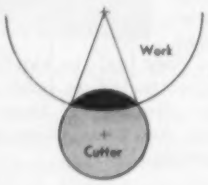
Whenever required, Barber-Colman engineers, by mathematical computation, design the correct cutter which compensates for the generating action. In this computation, the diameter of the cutter is very important since the amount of tooth form correction increases as the diameter of the cutter increases. A thread produced by a specially-developed cutter will have an accurate form which will fit the gage with the desired bearing.



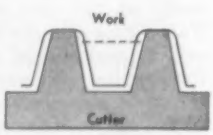
This schematic drawing shows how a multiple thread milling cutter produces a thread space which is wider than the cutter tooth. The cutter is set so that the plane of rotation of the cutter tooth is perpendicular to the work axis, and at an angle to the thread helix.



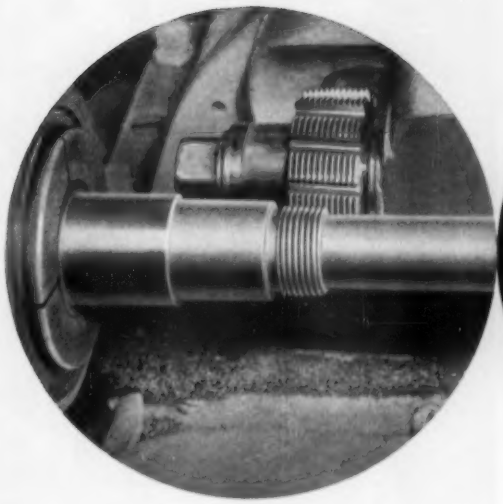
Large diameter cutters have greater length of contact and produce more pronounced fillets.

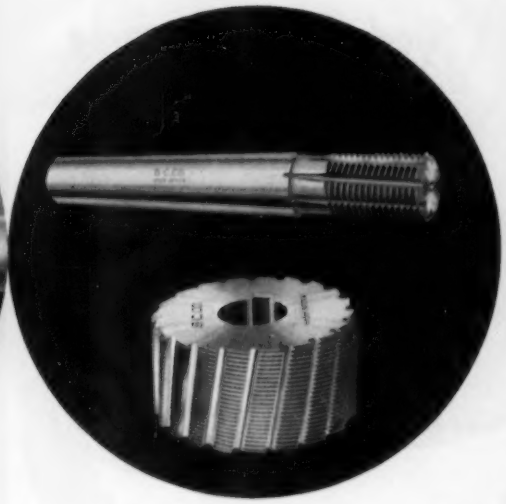


Small diameter cutters have less length of contact and produce smaller fillets.



In some cases, cutters mill deeper than true thread form. Any generated fillets which may be cut are then below the gaging surface of the thread. Correct cutter design takes care of this automatically.





original cutter accuracy in resharpening

All Barber-Colman form-relieved milling cutters are accurately index-sharpened on Barber-Colman automatic sharpening machines, so that all cutter teeth are the same height and accurately spaced. This makes it easy to maintain original cutter accuracy when resharpening either on automatic sharpeners, or on conventional sharpening equipment using the accurately indexed cutter teeth as a reference. In either case, accurate sharpening to original tolerances is easily maintained, and cutter sharpening time is reduced to a minimum.

design elements for maximum performance

With the proper tooth form developed to cut accurate threads, the engineers then analyze the job conditions to determine which cutter features will produce best cutter performance. These features include selection of the proper cutter material, shell or shank type cutters, straight or helical flutes, rake teeth, axial relief and intermittent teeth if sharp threads are desired. Since we make all classes of ground and unground thread milling cutters, we can recommend the cutter accuracy required for your job.

When you have a threading problem, consult Barber-Colman cutter engineers for their recommendations on the proper cutters for the job. Be sure the cutters you have are accurately designed to cut the correct thread form. Send us blueprints of your threaded parts for quotation on thread milling cutters designed to produce correct threads.

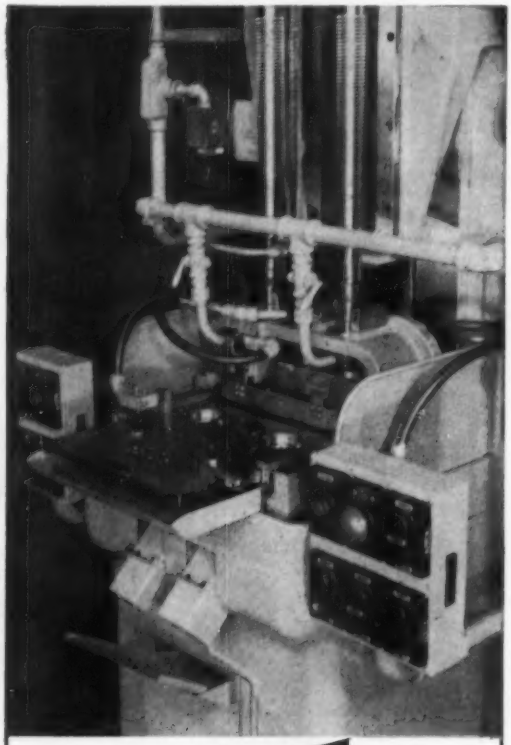
BARBER-COLMAN COMPANY

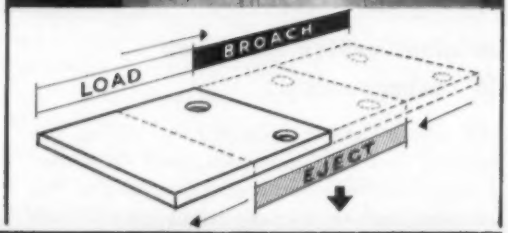
8112 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

Modern bike gearing





Another *American* First

45 GEAR TEETH BROACHED IN 360 RING GEARS PER HOUR

Here, an American 3-Way, pull-down broaching machine broaches 45 teeth in the ring gear for a two-speed bicycle transmission — two gears with each pass, 360 pieces per hour. A two-station fixture mounted on a 3-position hydraulic slide moves the parts into broaching position. The parts are broached after which the slide moves back, automatically ejecting the parts. The operator reloads while the broaches return. The machine can be run on automatic cycle. The operator only has to feed parts to the fixture.

American 3-Way Broaching Machines can be supplied with either electrical or manual controls, with fixtures and broaches designed to your requirements. Write for Catalog No. 101.

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

you can SAVE TIME and MONEY on jobs like this with the

...GISHOLT SPEED SELECTOR!

HERE'S WHY:

No manual gear shifting! You simply turn this hand wheel or touch a trip lever (for Direct or Pre-set operation). Shifting is automatic—by hydraulic power—while the operator positions the new tools for the next cut.

It's all so much simpler with the Speed Selector. There's no need for time-wasting computations, no mental effort, no physical effort. With simple controls, either direct or prearranged, the operator gets the ideal f.p.m. cutting speed for each cut. And it's *much faster,* of course!

The Speed Selector is standard on Gisholt Nos. 4 and 5 Ram Type Turret Lathes and on all Gisholt Saddle Type Lathes.

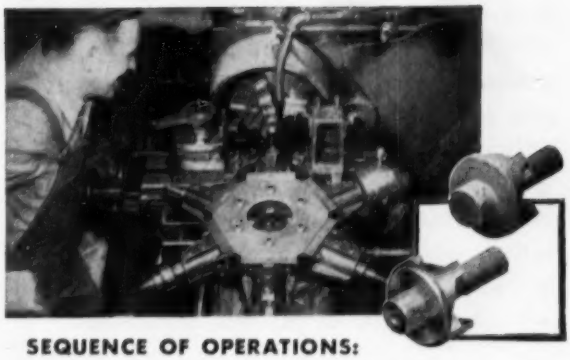
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

HERE'S HOW:



SEQUENCE OF OPERATIONS:

Note the star which indicates each time the Speed Selector is used.

★ **1. Hexagon turret—Center drill at 297 r.p.m. hand feed**

2. Hexagon turret—Support with live center

★ **3. Square turret—Rough turn and face at 96 r.p.m., .003 feed**

★ **4. Square turret—Finish turn, face and chamfer at 126 r.p.m. .002 feed**

★ **5. Hexagon turret—Start and drill through at 226 r.p.m., .003 feed. Trip the Hi-Lo lever, eliminating even the need for turning the hand wheel**

★ **6. Hexagon turret—Thread with tap at 39 r.p.m., leaders and followers**

—and you're ready for a new workpiece

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

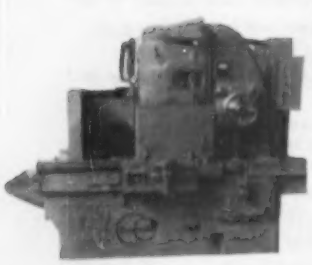
Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to ***"PUT IT ON THE BLANCHARD".***



P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!

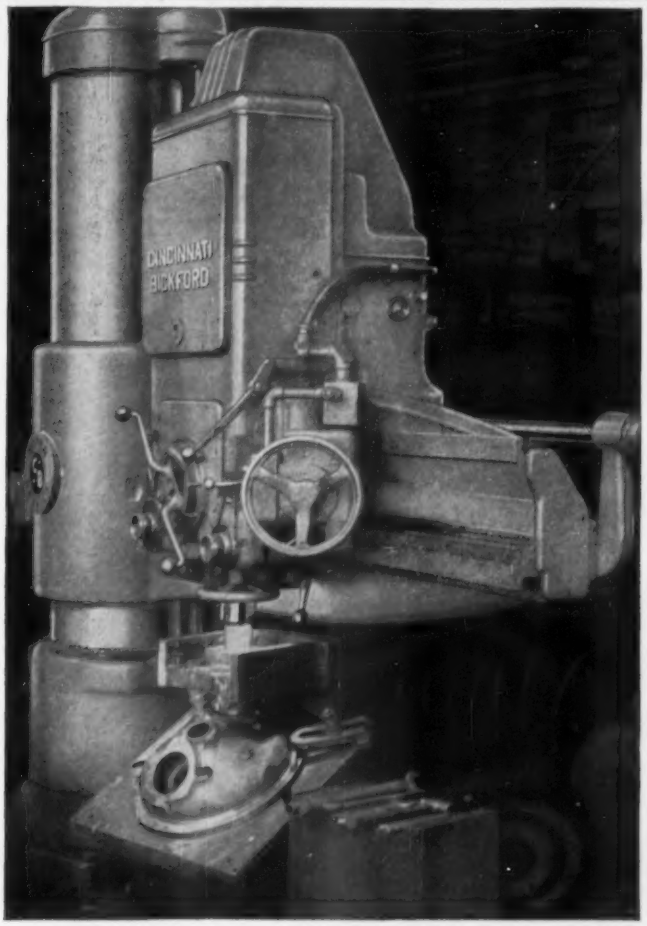
Send for free copies of "Work Done on the Blanchard"

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

There is so much difference in

its PERFORMANCE . . .



says:

JOY MANUFACTURING COMPANY
MICHIGAN CITY, INDIANA

Shown here is one of several new modern Super-Service Radial Drills recently installed in the plants of Joy Manufacturing Company. This one at Michigan City, Indiana, is boring air compressor cylinder heads for 5½" dia. valve cages. Of this machine the user says: "It is so much better in its performance and ease of handling that it is difficult to describe".

Two convenient dials control the complete hydraulic preselection of all speeds and feeds. Controls for hydraulic clamping of column, arm and head; and for arm elevation by power are at the operator's finger tips. Write for Booklet R-33, describing this ultra-modern tool.

CINCINNATI BICKFORD

SUPER C B SERVICE

G&L

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL COMPANY
OAKLEY, CINCINNATI 9, OHIO, U.S.A.

Mr. Smith's books showed an excellent cur-

Mr. Smith goes to Florida

OAKLEY, CINCINNATI 9, OHIO, U.S.A.

Mr. Smith's books showed an excellent current ratio. His cash position was good; his surplus was substantial. Shortly thereafter, however, he entered a premature retirement.

He had overlooked the fact that a large part of his company's fixed assets were machine tools, and their values shown on his balance sheet were simply bookkeeping entries. Those values didn't reflect obsolescence, nor show how expensive indirect labor, nonproductive floor space and downtime can be.

A closer look at your balance sheet may reveal the wisdom of investing in new production equipment. Its high rate of return makes good balance sheets better.

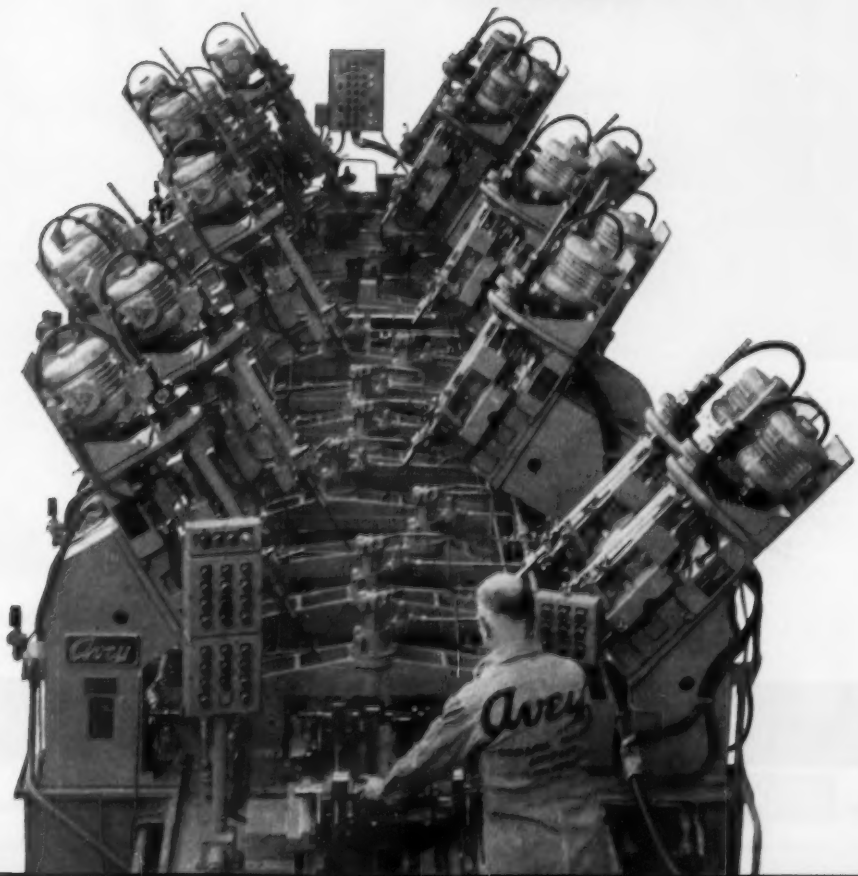
The 14-station machine has Line-O-Dex indexing, automatic hydraulic clamping and positioning, and drills ¼" holes with Aveydraulic Torquematic deep hole drilling units.

When this order is complete, or the part changes in design, the Avey standard units can be rearranged for a new job ▶*an economical way to extend the life of your investment.*

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

Avey



HARDINGE
ELMIRA, N.Y.

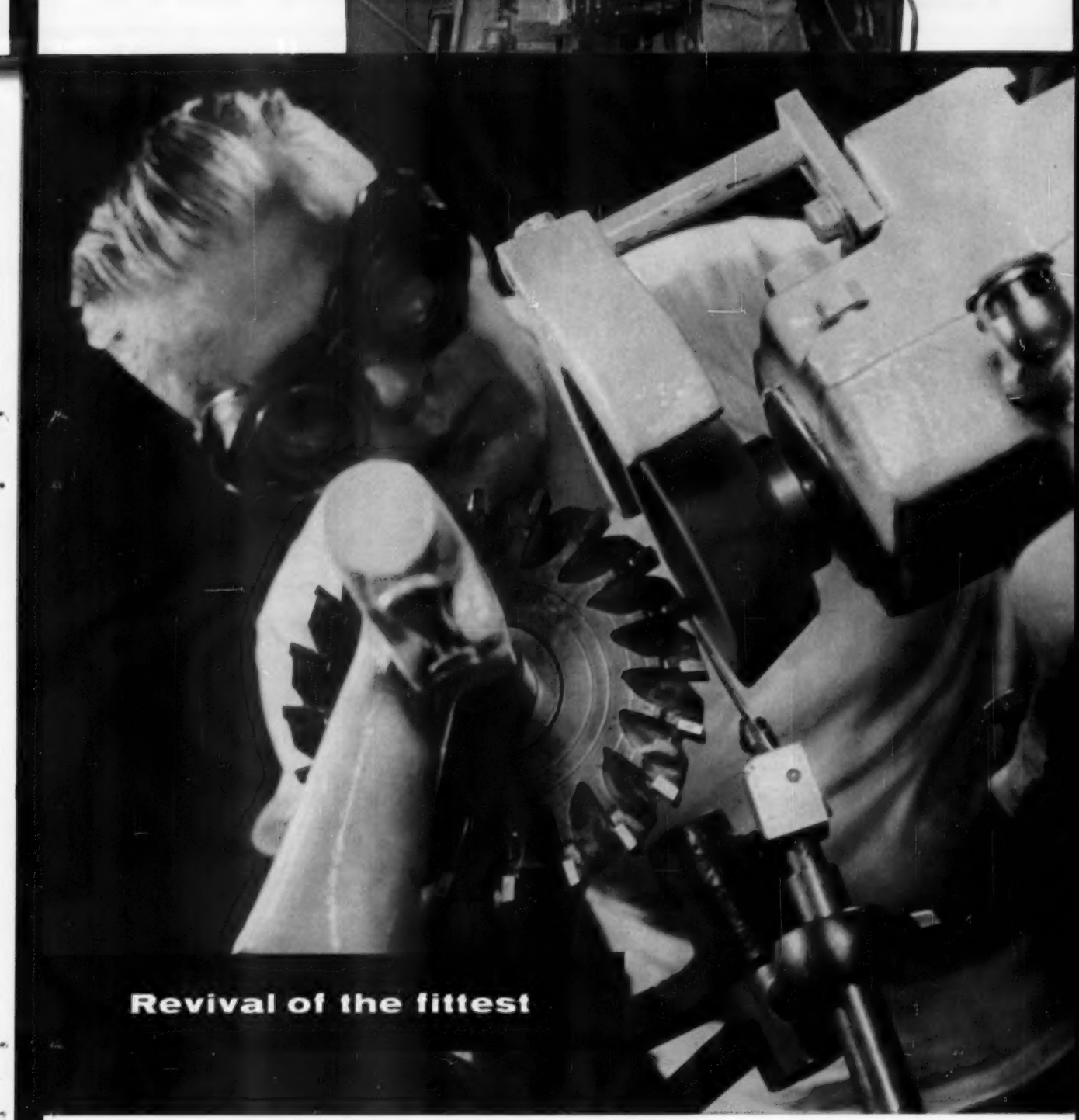
Variable Speed Machine
for
PRODUCTION DEPARTMENTS

Produce More Precision Parts at Lower Cost with this NEW Second Operation Machine

Send for Free illustrated Bulletin DSM59

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York, N.Y.

HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.



Revival of the fittest

Your best first step in giving dull cemented carbide tools a new lease on life is to select a "Green-Grit" silicon carbide wheel by CARBORUNDUM. For milling cutters and other multiple-point tools, where finer finishes are required, "Green-Grit" resinoid bond wheels offer superior form-holding ability. Even with heavier infeeds, they cut free and cool. In roughing operations, where stock removal is more important than finish, you'll find "Green-Grit" vitrified bond wheels your best bet. They permit both steel and carbide to be ground together—with outstanding results.

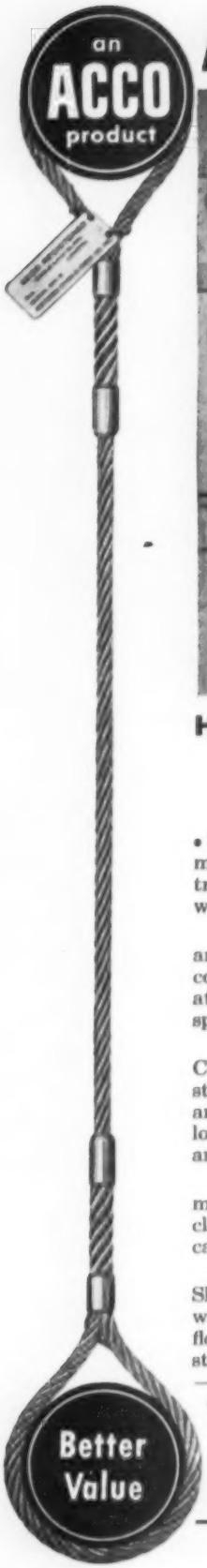
Your CARBORUNDUM Distributor or salesman can help you choose the right "Green-Grit" wheel for every job. Call him today. For Booklet A-1208 on carbide grinding, write The Carborundum Co., Niagara Falls, N. Y. In Canada: Canadian Carborundum Co., Ltd., Niagara Falls, Ont.

Through application "know-how" and product quality

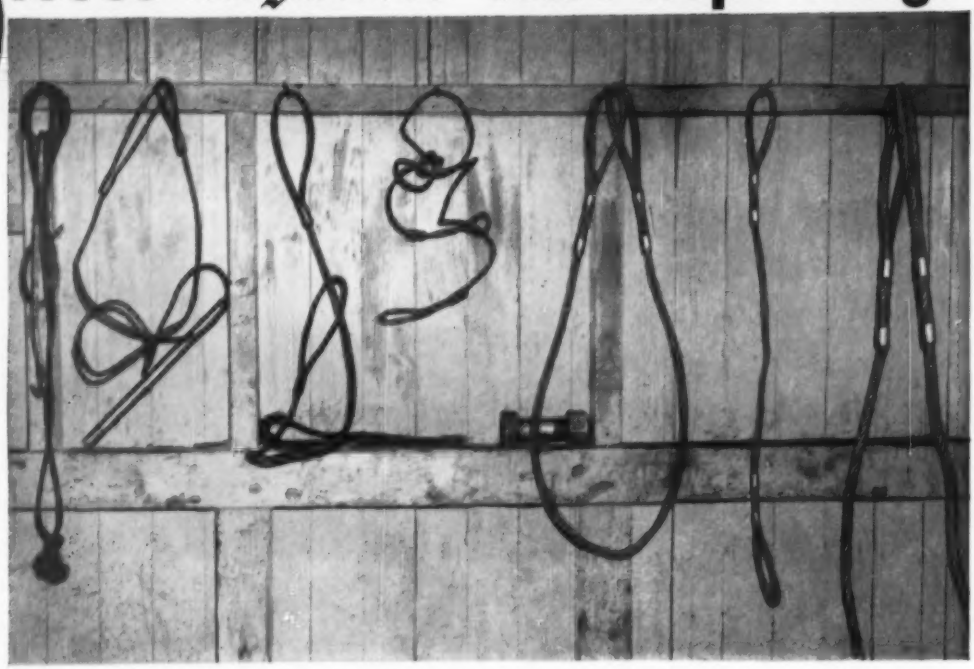
CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar



ACCO Registered* Wire Rope Slings



HERE'S PROOF OF FREEDOM FROM KINKING . . .

with Cable-Laid Slings

• This sling board in an eastern plant may not make a pretty picture. But it beautifully illustrates savings in handling and production time which can mean big money.

At the far left are a length of hemp rope and metal barrel tongs. Next, three standard construction wire rope slings. The three slings at the right are ACCO *Registered* Slings in our special Cable-Laid construction.

Note the startling difference between the Cable-Laid Slings and those of standard construction. The standard slings are badly kinked and snarled. Hard to handle, they require much longer to rig up—add drastically to production and handling costs.

The Cable-Laid Slings have seen just as much service, possibly more. Yet, they're bright, clean and almost as straight as the day they came from the factory.

CUT RIGGING TIME • For ACCO Cable-Laid Slings combine extreme resistance to kinking with freedom from crankiness. They give the flexibility of manila rope with the strength of steel. As a result they handle easier—save time—cut operating costs.

These qualities are only possible through the combination of a special wire rope construction and the patented DUALOC ending. GALACCO coating keeps Cable-Laid Slings clean and bright and provides maximum corrosion-resistance.

SAFEST SLINGS MADE • ACCO Cable-Laid Slings are registered—incorporate extra safeguards which make them the safest slings made.

Each individual component, made from the highest quality material suited to its use, is tested before assembly—must prove to have strength equal to or greater than the sling body. These components are assembled into slings according to precisely-engineered designs which have proven their safety and reliability in extensive field tests.

Each completed sling is then proof-tested at twice the load-carrying capacity for which it is rated. Then, and only then, does it receive the coveted registration certificate and tag.

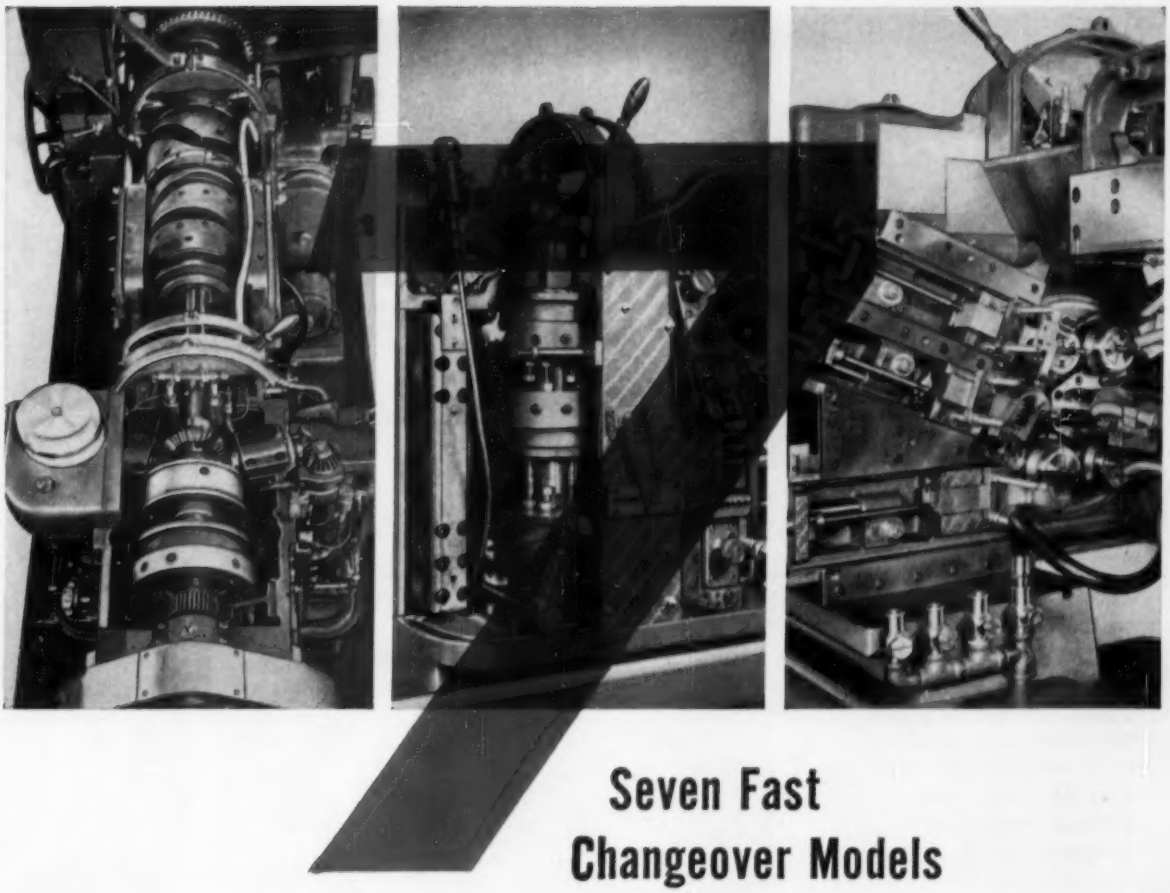
Get the details on Cable-Laid, or any other ACCO *Registered* Wire Rope Slings, from your distributor—or call the nearest ACCO district branch below. *Trade Mark Registered

FREE FOLDER • Write Wilkes-Barre office for your copy of new folder **DH-532**, which gives strengths and weights (for six different lifts) on a full size range of ACCO *Registered* Cable-Laid Slings.

ACCO

American Chain & Cable Company, Inc., Wire Rope Sling Department

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

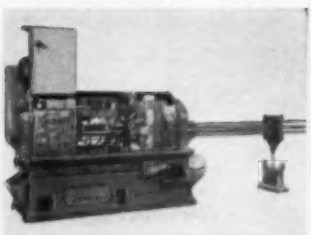


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

dixi 60

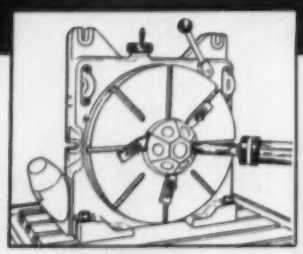
horizontal optical jig borer

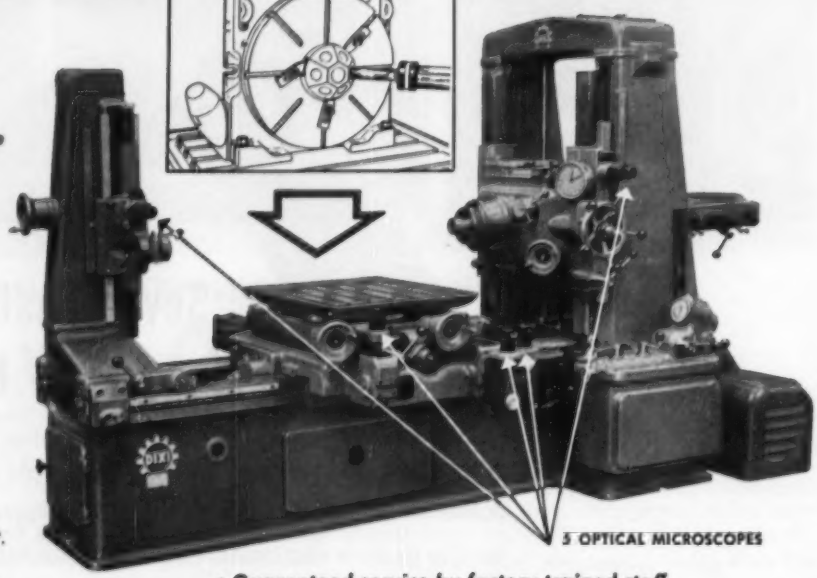
with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

ACCURACY
Overall accuracy of .0002"





A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32¾". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.

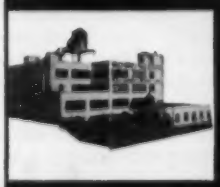
- *Guaranteed service by factory trained staff*
- *Engineering staff available for consultation*
- *Spare Parts in New York stock*
- *Your operators trained*

DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.
Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

MBI



For Headquarters in New York City

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export & import ltd.
A Division of Machinery Builders, Inc.
475 Grand Concourse, Bronx 51, N. Y.
"Over 20 years experience in designing & building machinery"
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CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

THREADWELL'S New
TAP PRIMER
—for the newcomer to the metalworking field an introduction to the science of tapping explained in simple terms.
—for the old hand, a convenient refresher and reference.
Get your copy now.

THREADWELL TAP & DIE CO.
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I'd like .....copies of the new Tap Primer.

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C

Now . . .

GET BOICE WISE

WITH A TRI-O-SET

Save

approximately $200.00

3 Famous Dial Bore Gages—Setmaster—Carrying Case. Save close to $200.00 on items in TRI-O-SET alone, to say nothing of the savings through use of the Setmaster.

#0 Dial Bore Gage—Range ⅛ to ¼"
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#2 Dial Bore Gage—Range ½ to 1"

Just three gages cover ⅛ to 1" . . . Ten extensions for the entire range . . . .0001 Indicator
Quick interchangeability . . . Equalizers from ¼ to 1"

TRY the TRI-O-SET . . . Ask about the Boice Free Trial Offer

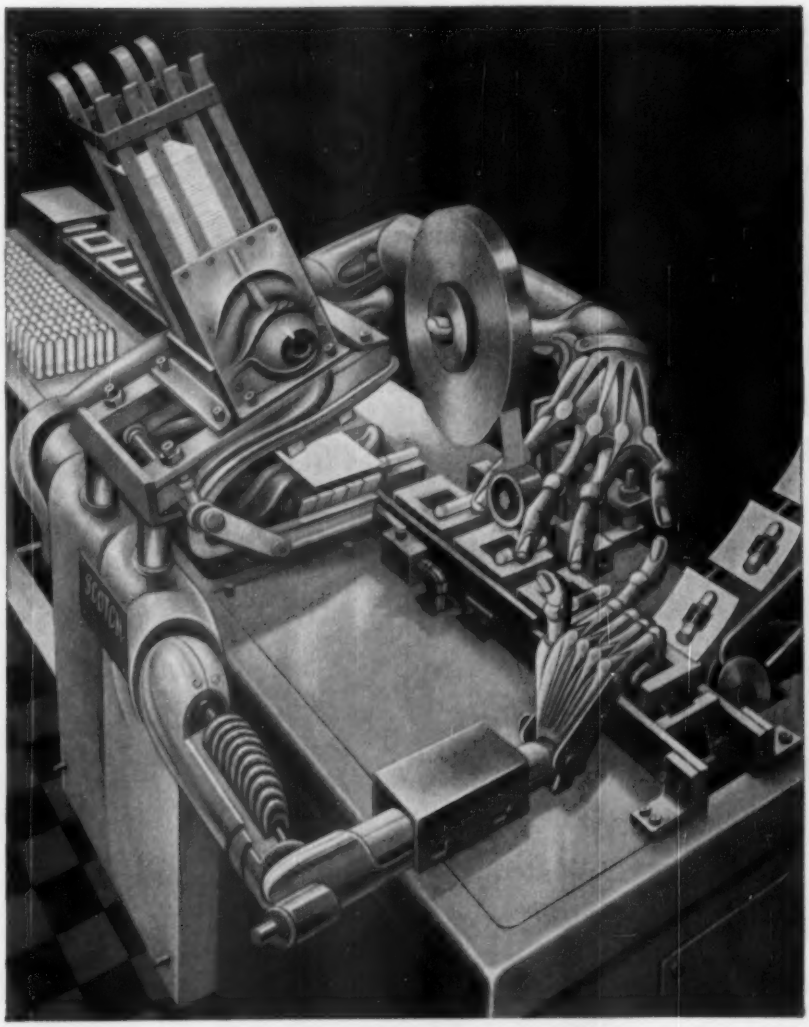
For additional information, contact manufacturer

Local representatives in all major cities in the United States and Canada.

SETMASTER

Eliminates costly precision rings
Easily set with wires or Jo Blocks
Set to "X" accuracy
Sets up in less than a minute
Keep at the job for "on-the-job" use
Masters the 3 gages—Range 0 to 1"

BOICE GAGES
HYDE PARK, New York
BOICE BY CHOICE



AUTOMATION? you name it...we'll tape it!

Whether your packaging problem is as light as affixing lipsticks to resale display cards . . . or as heavy as bundling heavy-wall pipe . . . or as utilitarian as sealing and reinforcing a carton . . . or just about any sealing, labeling, holding, binding, or banding job in between . . . you can probably get an automatic or semi-automatic machine to do the job better, faster, and cheaper using "SCOTCH" Brand Pressure-Sensitive Tapes. Your regular tape distributor will be glad to discuss your particular needs without cost or obligation. Or, write us for the booklet described at right.

PRODUCT OF 3M RESEARCH **DISPENSERS** *for the more than 300 pressure-sensitive tapes for industry, trademarked . . .*

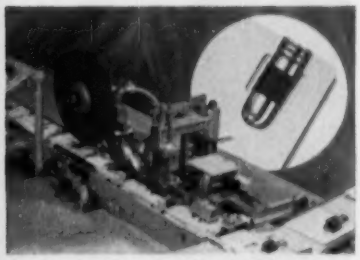
REG. U.S. PAT. OFF.

SCOTCH BRAND

The term "SCOTCH" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.

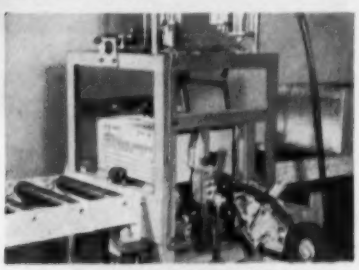
3M

Look what you can do with dispensers!



TAPE small items to display cards with a "SCOTCH" Brand Tape Stapler, (dramatized by Artzybasheff at left). Operates at speeds up to 80 units a minute; handles a variety of "SCOTCH" Brand Tapes.

BUNDLE heavy conduit, rigid wall pipe, bar stock at rate of 3 bundles a minute. Machine automatically wraps "SCOTCH" Brand Filament Tape—the world's strongest tape—around both ends of bundle.



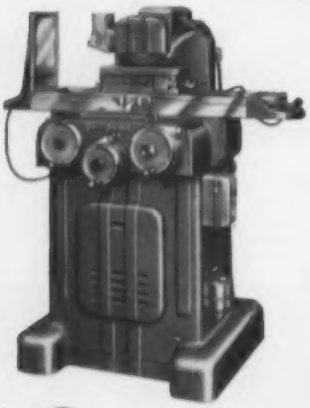
CLOSE and reinforce full telescope cartons with "L" shaped clips of "SCOTCH" Brand Filament Tape. Automatic Box Taper handles up to 10 cartons a minute . . . can be integrated into conveyor line.

SEND FOR illustrated manual describing "SCOTCH" Brand Dispensers and Applicators for nearly every taping need. Just write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. MA-126.

SPARK TEST

Shows how a Taft-Peirce No. 1 Surface Grinder Repeats to .00005"

Here is a surface grinder so accurate that few people would believe it until this simple demonstration was devised.



Take a side wheel grinding setup. Grind to a zero reading on the cross feed dial. Move the work away one or two thousandths with the cross feed vernier, then back to its original position. NOTE: There's no grinding spark. Now, feed in ½ of a tenth with the vernier and SEE THE GRINDING SPARK.

To our knowledge there's never been a standard grinder built before that even comes close to the accuracy of a T-P No. 1 Surface Grinder. An experienced operator frequently can grind to less than .00005" . . . with surfaces so smooth, in many cases, they seal without lapping.

Table, saddle, and column travel on anti-friction bearings retained in vees of hardened and ground alloy steel. Tilting wheelhead simplifies setups. Vernier fine-feed attachments, graduated in .0001" increments spaced ½" apart, are available for either the horizontal or vertical feed.

Compact, yet heavier than other machines, the No. 1 Surface Grinder maintains its accuracy over many years of rugged service. For more information, write for bulletin.

Rotary Surface Grinders

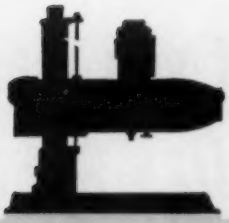
Precision Surface Grinders

Lapping Machines

Back Spot Facing Machines

T-P means Top Precision T P

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND



NEW HEAD CONTROLS make Fosmatic Radial easier than ever to run!

Numerical Dials select feeds and speeds quickly, easily, with minimum possibility of error. Select even while drill is running, to save time on next operation.

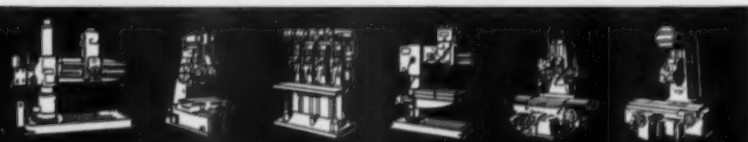
Single Control Lever starts, stops, reverses and shifts to feed and speed set on numerical dials.

Push Buttons on quick return levers engage feed. Feed is disengaged automatically by depth control or by pushing either button again. Magnetic clutch needs no adjustment.

Head Traverse Lever also elevates arm. Variable speed hydraulic motors drive both traverse screw and elevating nut. Clutches eliminated.

Other Fosmatic features include: 36 spindle speeds, 18 feeds, 4' to 8' arms, 13" to 19" columns, Boring Type Spindle, Safety Interlocks, Variable-Tension Counterbalance for Spindle, and optional Milling Feed.

NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK

if you manufacture parts

like these...

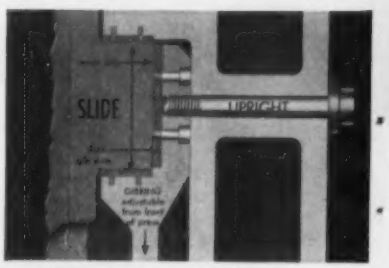
A BLISS HIGH PRODUCTION PRESS

may triple your output...or more

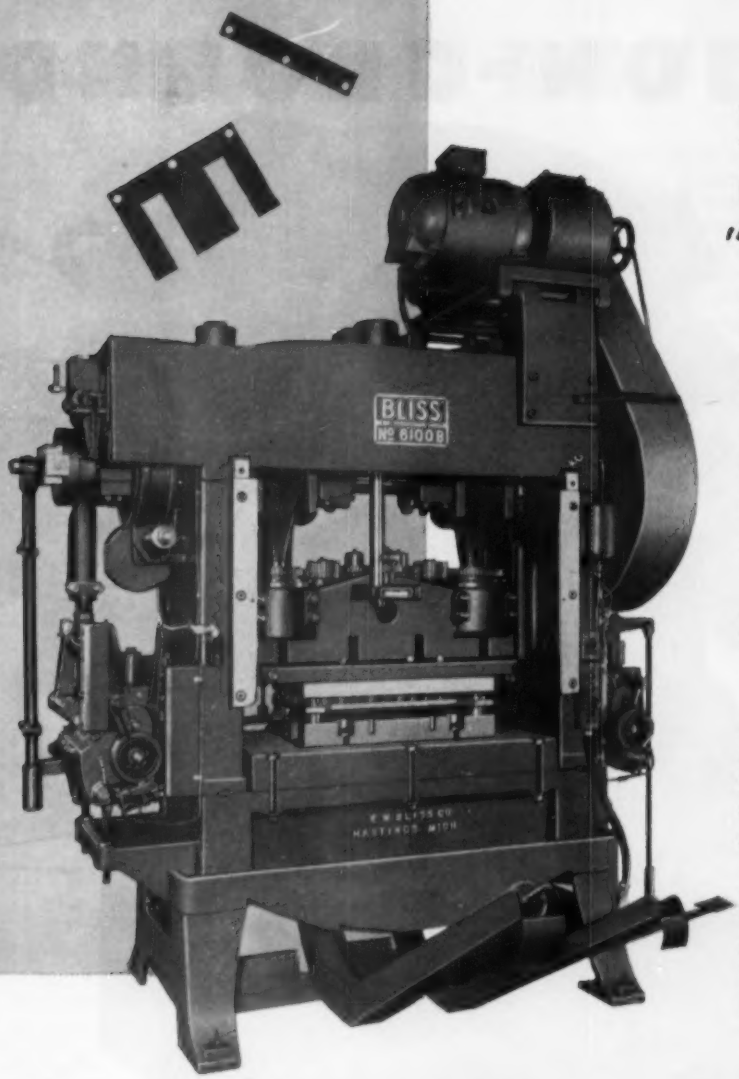
EXCLUSIVE DESIGN FEATURES... assure accuracy at high speed

RUGGED FRAME: The dense, cast Meehanite frame *absorbs sound*, eliminates ringing "ping" at high speeds. Heavy four-piece frame members are keyed and joined by steel tie rods which are "pre-shrunk" to a tension greatly exceeding press capacity. Extra heavy sectioned bed and crown holds deflection to a maximum of 0.001" per foot at press capacity under normal loading conditions. Heavy reinforced crown gives extra support to the shaft. The design of the frame leaves plenty of room for die set up—provides chute space *under* the press.

VARIABLE SPEED DRIVES are standard on H-P presses so that each job can be run at its most efficient speed.



SQUARE GIBS provide precision fit—no more than a 0.0015" feeler goes between gib and slide, although slide moves freely. Location of gibs close to centerline resists tendency of slide to tilt under off-center loads—slide is held parallel to bed within 0.0005" per foot on all dimensions.



Long runs not essential, users report

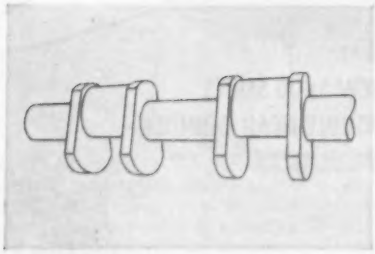
"we set up in 15 minutes, run 3000 parts in another 10..." is typical experience

Consider this: a Bliss H-P Press is usually able to replace from 3 to 12 older and slower presses. And the savings in space, tooling and handling costs alone are often enough to write off the cost of a H-P press.

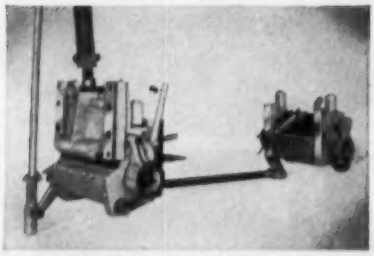
But the really important saving is in the cost of the parts themselves, because you get so many more so much faster and dies last so much longer.

Fast set-up makes that true for both long and short run work. IBM, for example, needs only *eleven* H-P presses to turn out multi-thousand quantities of more than 1500 different parts every three months Their average set-up time: 48 minutes.

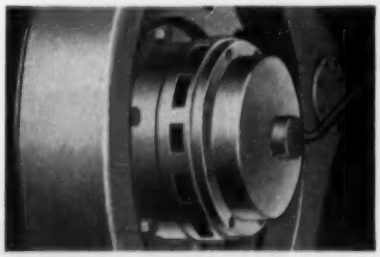
H-P presses are available from 12 to 300 tons, non geared or single geared. Special designs, special feeds extend their use to practically all stamping requirements. We'll be glad to send you complete information by return mail.



COUNTERBALANCED to eliminate vibration. Slide and tools are counterbalanced by means of air cylinder in crown. Where top speed of press requires, the crankshaft is dynamically balanced and the throwblock for the feed is balanced by a compensating weight on the feed adjusting screw.



BLISS FEEDS: Bliss makes its *own* single roll, double roll and special feeds to assure accurate feeding at high speeds. Typical of Bliss design is its roll feed clutch—with *eight* or more rollers bearing on *Stellite* inserts in the hub, it gives greater accuracy *longer*.



AIR FRICTION BRAKE AND CLUTCH: Special design gives die setter and operator complete and accurate control of the press. Air pressure can be set so clutch will slip under severe overloads. In addition, this cool-running clutch automatically adjusts itself for wear.

BLISS
SINCE 1857

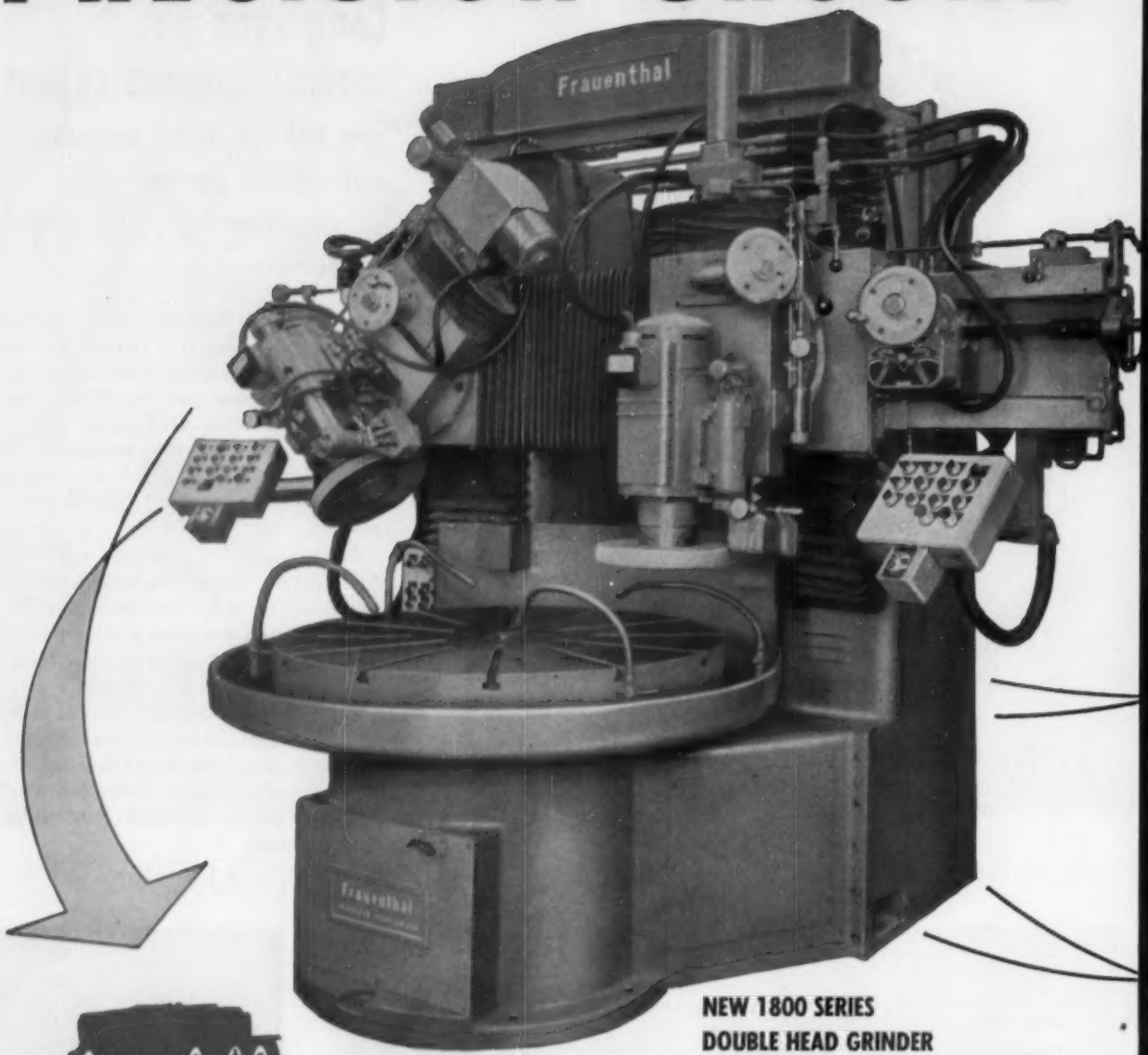
is more than a name...it's a guarantee

E. W. BLISS COMPANY, Canton, Ohio

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pennsylvania. Branch Offices in Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Pittsburgh, Rochester, San Jose, Toledo, Washington, D. C.; and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. Other representatives throughout the world.

PRECISION-GROUND

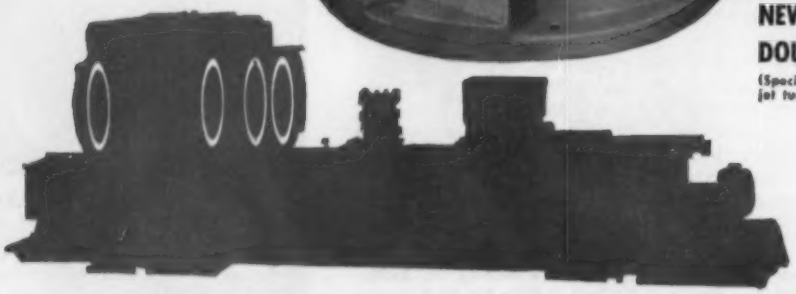


NEW 1800 SERIES
DOUBLE HEAD GRINDER

(Specially equipped for grinding jet turbine blades)

Free Catalog!

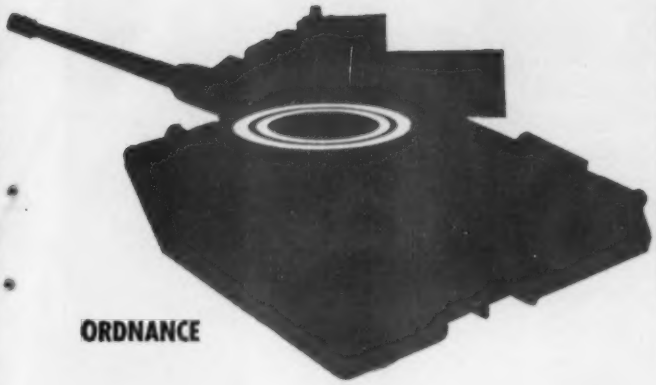
For complete details on Frauenthal 1800 Series Double Head Grinders, write for catalog.



MACHINE TOOLS

Frauenthal Division

COMPONENTS . . .



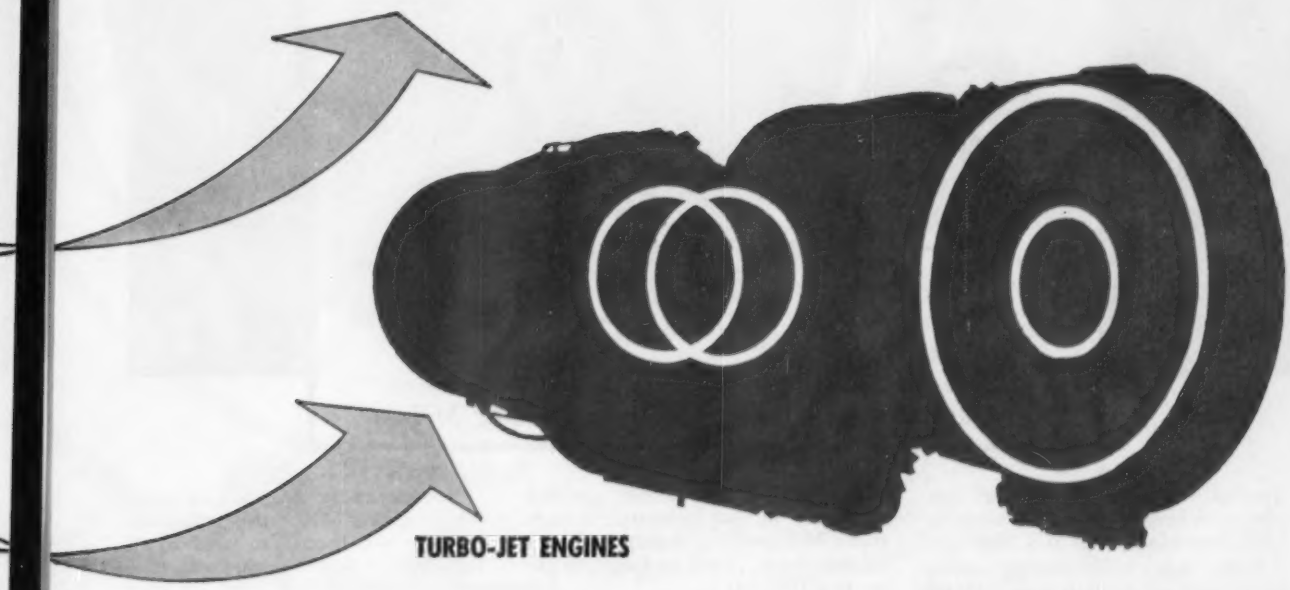
ORDNANCE

WHATEVER YOUR FIELD OF INDUSTRY — With Frauenthal precision machines, you're able to grind diameters and related surfaces without changing setup of the workpiece and obtain accuracies within .000200". This assures consistently uniform precision in concentricity, parallelism and roundness.

The accuracy and versatility of Frauenthal equipment is unequalled in the machine tool field. Difficult work-pieces — those impossible to handle on conventional horizontal grinding equipment — are handled with comparative ease on these unusual machines.

Four different series of machines are available affording table sizes up to 140". The 1800 Series Double Head Precision grinder, illustrated at left, is now available with a maximum swing of 72" and various table sizes to suit customer specifications.

For complete details, contact Frauenthal of Muskegon, Michigan.



TURBO-JET ENGINES

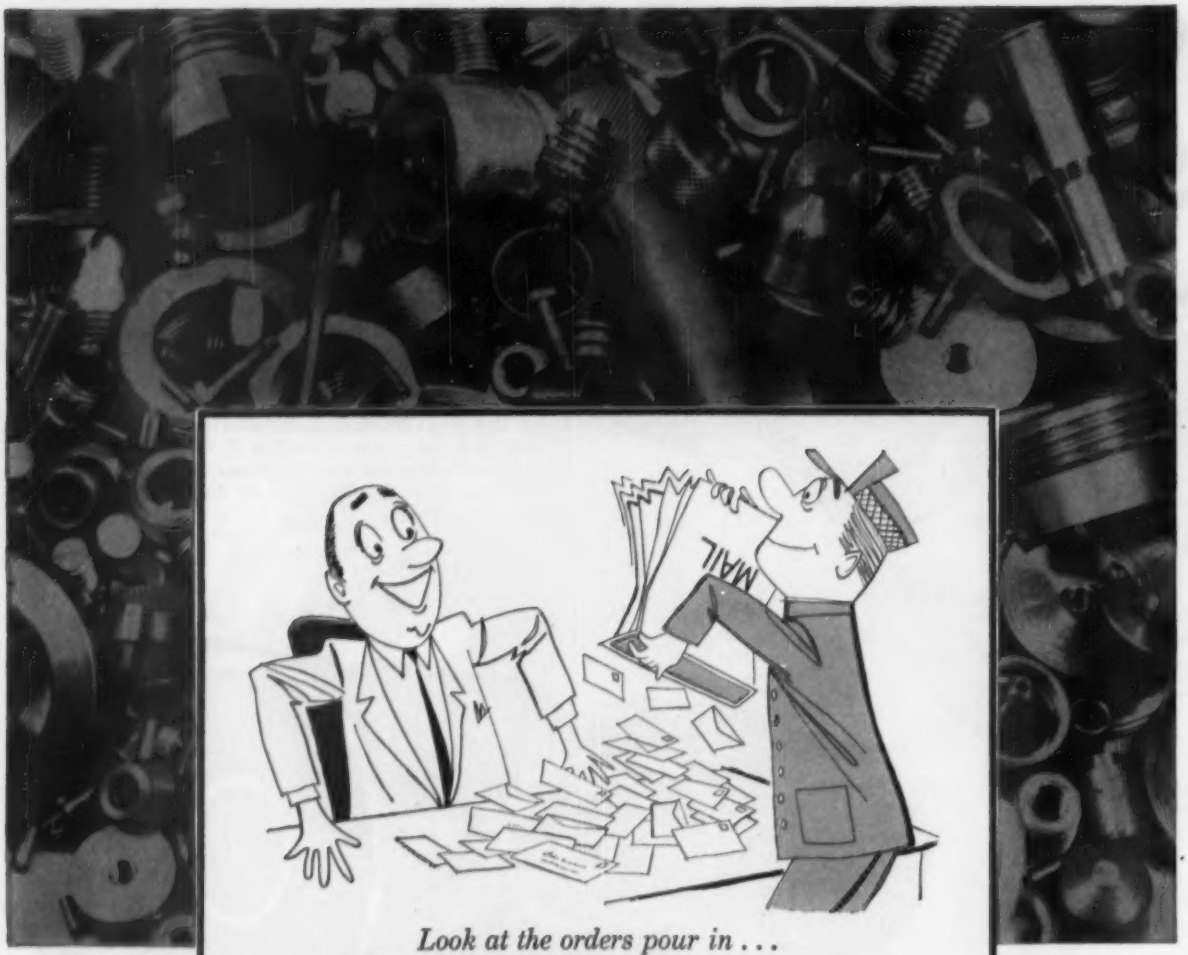
MACHINE TOOLS — Modern day machine tools are required to produce piece parts to greater accuracy than ever before. Therefore, machine tool components must be more precise to the nth degree. With Frauenthal grinders you can grind collets, chucks, spindle sleeves and similar components under simulated assembly conditions to assure concentricity, parallelism and roundness. Eliminate costly and time consuming hand scraping and grind plated parts prior to and after plating for increased wearability.

TURBO-JET ENGINES — Diffuser cases, rotors, compressor discs, vanes, etc., are components of jet engines ground on Frauenthal equipment. Thin section parts, which are unstable due to their design, are ground on the horizontal rotary table of the 1800 and 3100 Series machines. The compound and spindle angle setting features permit the grinding of surfaces normally inaccessible on conventional equipment.

ORDNANCE — Large bearings and housing components for ordnance applications are ground on the 1800 and 2200 Series grinders. Applications vary from aircraft gun turret bearings to the large turret bearings required for tanks, motorized gun carriages, radar and naval gun mounts.

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN



Look at the orders pour in . . .
now that we've got our prices down by using MX

You give yourself—and your customers—a break when you switch to USS Free-Machining MX Steel.

With this faster-cutting screw stock your production goes up and your costs come down. Your screw machine parts, no matter how intricate, can be turned out at higher speed. More accurately. With better finish. And with less tool wear.

Although it costs no more than ordinary screw stock, USS Free-Machining MX has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used for the everyday jobs which are the backbone of the industry. What's more, MX works *with* your tools not against them . . . will prolong tool life up to 200%.

As a result, cost savings with USS MX have run as high as 42%—generally average between 10 and 15%.

Such savings have been so consistently recorded in every shop where MX has been given a thorough trial that we feel safe in saying that *MX will cut the cost of any part* you now machine from ordinary screw stock. The more machine work required, the greater your savings.

You can easily prove this for yourself by giving MX a production run in your own shop. Produced in all the popular screw stock sizes, it is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trademark. In hot-rolled form, MX is available direct through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Longer tool life . . . bigger output . . . lower costs
—when you do the job with free-machining

MX

USS

UNITED STATES STEEL

Again . . .

"AMERICAN" expands the scope of Radial Drill usefulness

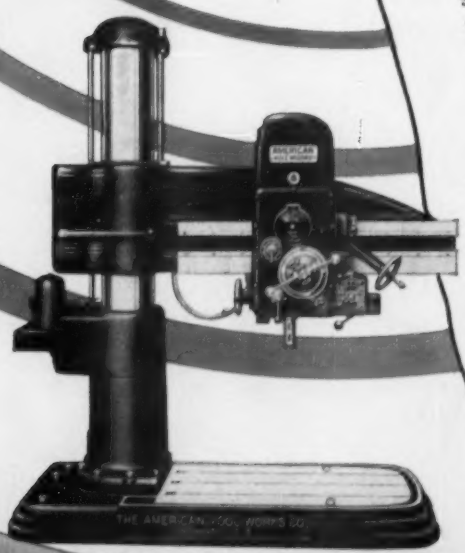
9 inch and 11 inch column "AMERICAN" HOLE Wizard Radials now may be equipped with a FINE FEED BORING ATTACHMENT.

This attachment furnished in addition to the standard feeding mechanism, merely by the flip of a lever reduces the standard feed range 75%.

The fine boring feeds thus provided are the answer to precision boring on radial drills. Many tool and die shops are already using them for high precision, fine finish boring of jigs and fixtures.

Another *first* of great value to help radial drill users to produce more and better work at less cost.

Bulletin No. 325 tells the story.

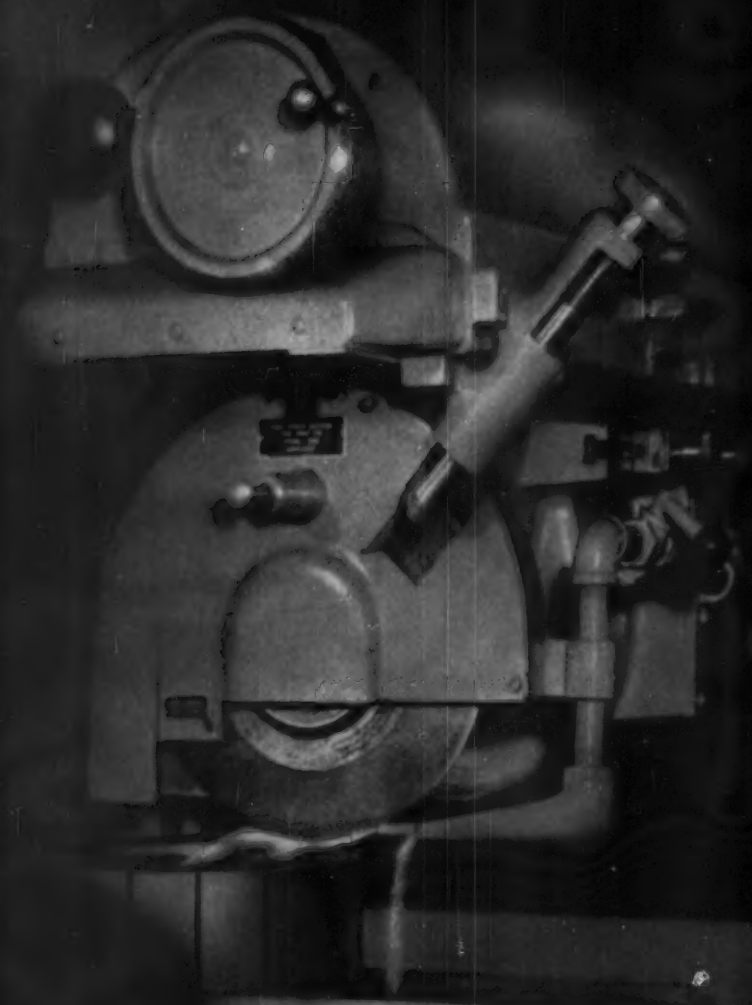


THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

WORLD'S MOST COMPLETE LINE

of hydraulic
surface grinders



invites your attention...

name the surface grinding job. . . Thompson has the machine

Thompson Type B

Surface dies or parts faster to part print, at lower cost, within wide size range

work size

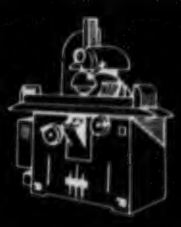
6" x 18" to 12" x 120"

Thompson Type F

For greatest precision, sensitivity and versatility in toolroom. . . or parts production at low cost

work size

6" x 18" and 8" x 24"



Thompson Type C

Meets production and cost demands in larger size surface work of all types

work size

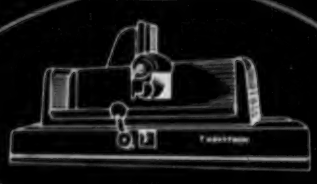
12" x 40" to 24" x 168"

Thompson Type CX

Offers both power and precision for heavy duty production. . . fast, accurate

work size

30" x 72" to 36" x 240"



Thompson SURFACE Grinders

Including a complete line of Truform, Hydrail, Twin Rotary and other special grinders for all sizes and types of work.

write for descriptive data

THE THOMPSON GRINDER COMPANY

SPRINGFIELD, OHIO

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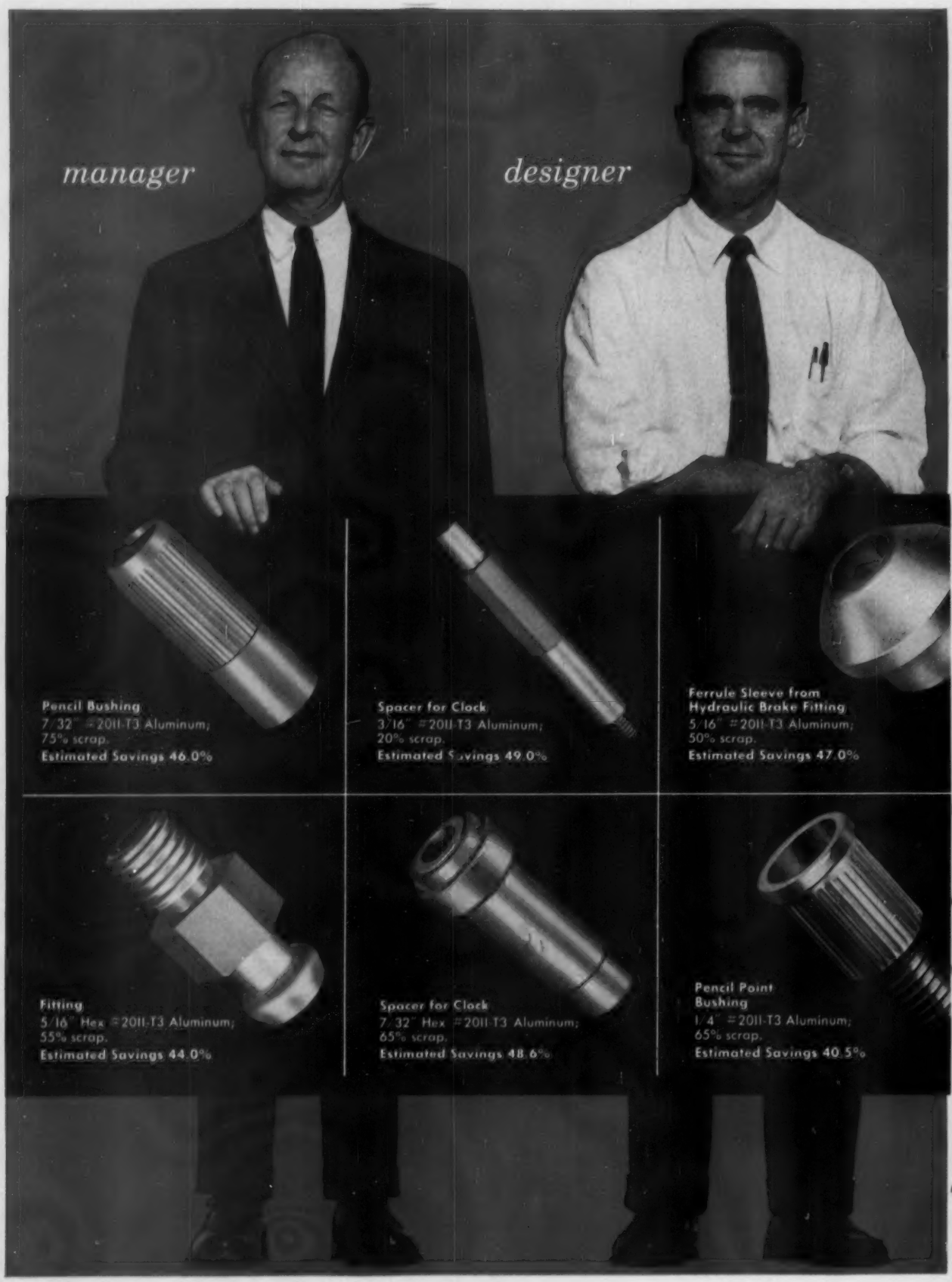
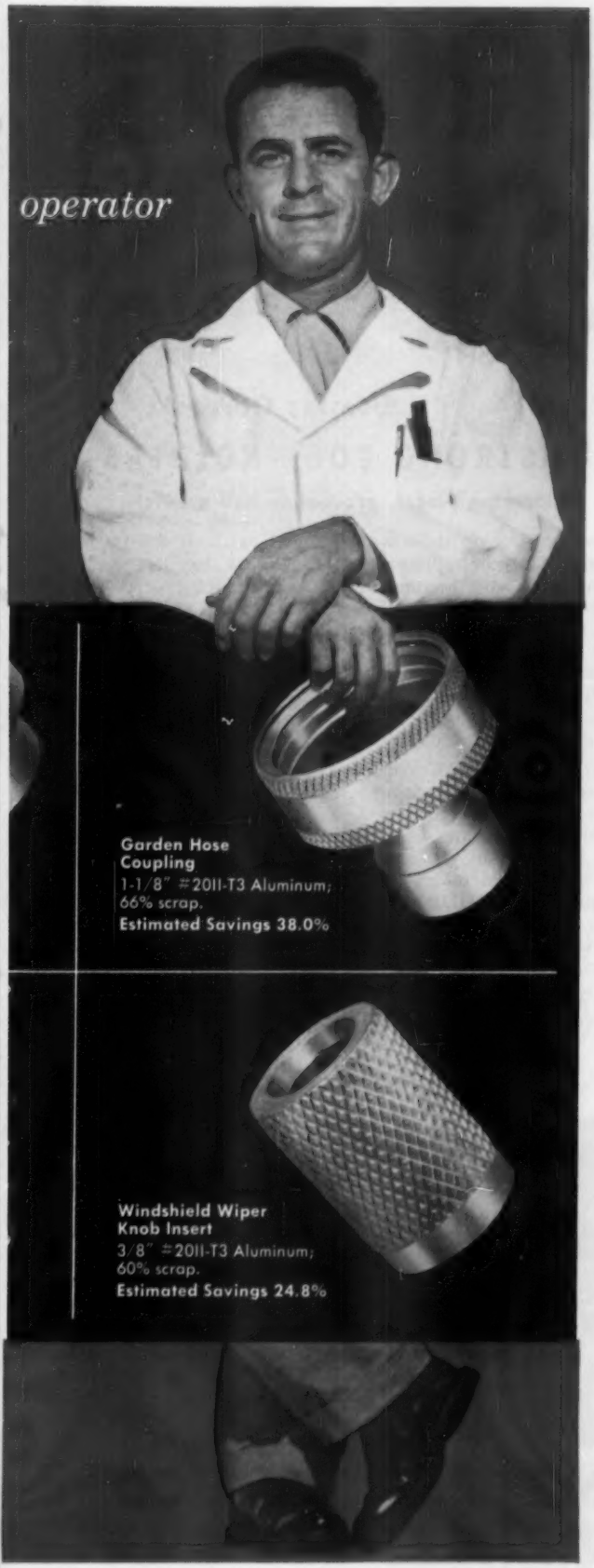

manager
designer
Pencil Bushing
7/32" ø 2011-T3 Aluminum;
75% scrap.
Estimated Savings 46.0%
Spacer for Clock
3/16" ø 2011-T3 Aluminum;
20% scrap.
Estimated Savings 49.0%
Ferrule Sleeve from
Hydraulic Brake Fitting
5/16" ø 2011-T3 Aluminum;
50% scrap.
Estimated Savings 47.0%
Fitting
5/16" Hex ø 2011-T3 Aluminum;
55% scrap.
Estimated Savings 44.0%
Spacer for Clock
7/32" Hex ø 2011-T3 Aluminum;
65% scrap.
Estimated Savings 48.6%
Pencil Point
Bushing
1/4" ø 2011-T3 Aluminum;
65% scrap.
Estimated Savings 40.5%

Copyright 1956 The Thompson Grinder Company



ASK ALL THREE

why these eight screw machine parts were converted from brass to Kaiser Aluminum...

Operators say "easy to machine"...

Designers say "exceeds requirements"...

Management says "saves money"...

and just look at these savings you as an operator can offer your customer with an alternate bid in

Kaiser Aluminum

For complete information and expert assistance, call one of our many distributors, or look for our local number in your classified telephone directory.

Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois; *Executive Office*, Kaiser Bldg., Oakland 12, California.

See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.

ARMSTRONG

Use the Correct . . .

ARMSTRONG TOOL HOLDERS

to increase pieces, production and profits!

Because they do their work so well, without repairs, maintenance or replacement . . . because they last for years and have become as much a part of everyday operations as steel itself, the importance of using the correct type and size ARMSTRONG TOOL HOLDER for each operation, is frequently overlooked. It should always be remembered that by controlling the cutting point, ARMSTRONG TOOLS control both the productivity and efficiency of every lathe, planer, slotter, and shaper in most shops.

Tools so vitally situated, no matter how trouble-free, deserve periodic checking . . . checking to see that the correct size and correct type ARMSTRONG TOOL HOLDER is being used for each operation: checking to be sure that you are taking full advantage of the new additions to the Armstrong System—the special types for ARMIDE (Carbide Tipped) Cutters, others for ARMOLOY (Cast Alloy) Bits and Blades; the new "spring" form threading tools and cutting-off, etc., etc.

Write for a recent ARMSTRONG Catalog and check your tooling of each operation.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

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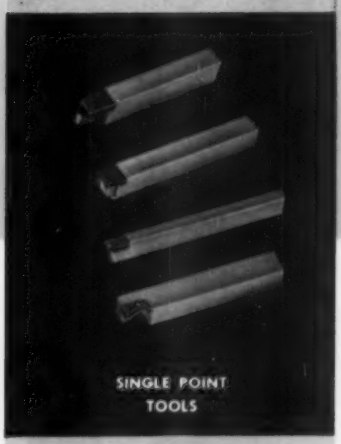
GROUND MULTIPLE THREAD MILLING CUTTERS

FORM RELIEVED MILLING CUTTERS



SINGLE POINT TOOLS

FORM TOOLS

BROACHES

FACE MILLS

CONTINENTAL DRIVE TOOLS

Newest Materials and Methods-

Plus the Toughest "Proving Ground" in Industry

What makes one tool better than another? Most engineers boil it down to these three factors: (1) careful selection of the newest tool materials, (2) proper tool design, (3) accurately controlled heat treatment.

Continental is constantly testing these three factors in one of the toughest tests in industry: the rugged day-in, day-out torture of actual production in Ex-Cell-O plants.

The results of Continental engineering and testing will be evident in your own cutting tool operations. Call your Ex-Cell-O representative or contact Continental direct.

CTW

Continental TOOL WORKS

Division of Ex-Cell-O Corporation, Detroit 32, Mich.

56-47

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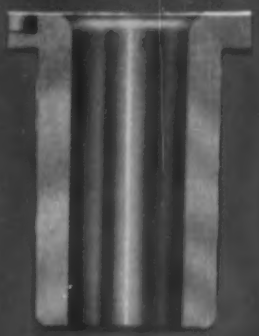
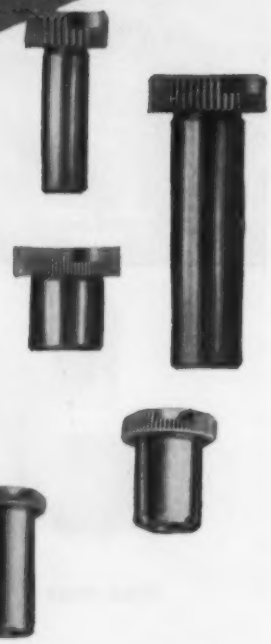
for accuracy in your production
it pays to specify

UNIVERSAL DRILL BUSHINGS

In Universal you get the best. Machined from finest quality steel. Blended radius on the top-inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip.



superfinish bores
lengthen tool life
The superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum—especially in close tolerance work.



Standard sizes and lengths in stock for immediate delivery. Contact the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Micro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

UNIVERSAL ENGINEERING COMPANY | FRANKENMUTH 1, MICHIGAN

56-47

Commercial TOOL WORKS
Division of Ex-Cell-O Corporation, Detroit 32, Mich.

*Controlled Measure

There's something majestic about a bridge. We often view it in its entirety . . . without appreciating the many components that contribute toward its strength as a unit.

Yet — even in such a huge structure . . . controlled measure is important.

Precision and balance of parts are carefully engineered for stress and strain. Each part must fit in ratio, as accurately as the intricate pieces of a delicate instrument.

Bath cylindrical plug or thread, ring or reversible type gages, guarantee controlled measure of component parts on the inspection line.

Made for dependable service and long wear-life . . . Bath gages are your best buy for reliable check of threaded and plain parts.

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CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS
INTERNAL MICROMETERS

*When you buy Bath Gages . . .
you buy controlled measure!*

*for the best buy
. . . buy Bath*

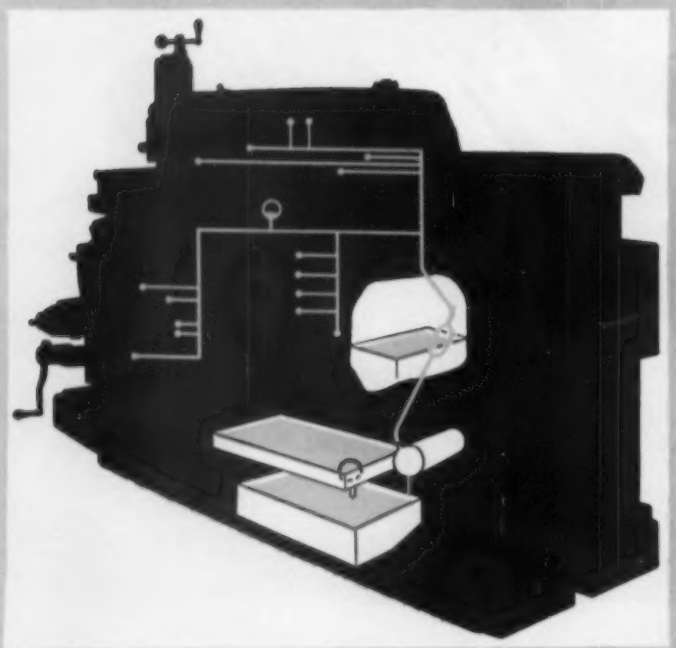
50 lbs. oil pressure

IS NECESSARY WITH A CUT LIKE THIS...

Demonstration cut on Cincinnati Rigid Shaper.
Actual size steel chip, 2" cut, .030" feed.

This tremendous cut demonstrates the ability of the 50 p.s.i. lubrication system to develop and maintain oil films under the heaviest loads.

It also demonstrates the strength, rigidity and power which are standard features on all Cincinnati Rigid Shapers.



Write for Bulletin "Cincinnati Rigid Shapers"

50 p.s.i. system includes 50 micro filter, settling basin and reservoir. Transmission runs submerged in oil.

The Electro-Magnetic Brake and Clutch with finger tip control are standard features on Cincinnati Shapers for maximum speed and ease of operation. ☆

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An Even Better

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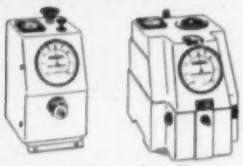
IMPROVED ZERO SETTING

The zero setting adjustment is improved mechanically. The pointer is set directly to zero — positively, without additional adjustment.

NEW PROTECTION FOR AIR METER

A new piping arrangement assures effective protection of the Air Meter from dirt, oil and water.

ONE THIRD SMALLER



Compact, easy to handle — more adaptable for use on machine tools. Beautiful, dirt-resisting finish.

NEW IMPROVED REGULATOR (At Top)

A better and smaller regulator assures constant air pressure and enables a reduction in size of the complete gage. Setting can be locked to prevent accidental change

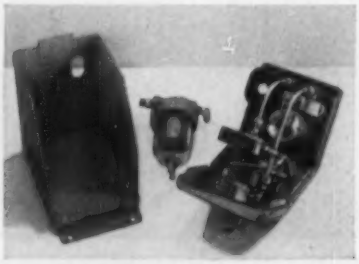
FINGER TIP ATTACHMENT OF GAGING UNITS

Knurled collar attaches all gaging units quickly: one hand only required. "O" Rings assure air-tight connection. No wrenches needed.

ONLY AIR GAGE WITH BUILT-IN ACCURACY THAT ENABLES USE OF ONE MASTER

BETTER FILTER with TRANSPARENT BOWL

New sintered bronze element filters out dirt and coagulated oil. Condition of air lines can be readily checked by observing filter bowl. Attached directly to gage, it eliminates extra piping.



ALL COMPONENTS EASILY ACCESSIBLE

One-piece top and front easily removed with all components and connections attached. Quick, easy servicing, if necessary.

DIMENSIONAIR

BASIC, NO-DRIFT SYSTEM

The Dimensionair system is basically sound in principle. Its accuracy is proved constant and dependable every day in practice.

However, no gage maker can control all the elements, human and technical, that influence the proper use of his product but he can incorporate features which tend to eliminate these faults and improve the actual use of his instruments.

That is the purpose of these new refinements which have been built into the Dimensionair.

Most air lines installed in plants were NEVER INTENDED to be used for precision instruments of any kind. Hence, the Dimensionair is now made EVEN MORE IMMUNE to unclean air and variations in air pressures.

Adjustments are more foolproof.

Smaller size makes the gage EASIER TO HANDLE and increases its adaptability for general use . . . and for multiple use.

Since any instrument is subject to all degrees of treatment it must be EASY TO SERVICE when the unusual or unexpected upsets its normal function. In the new and smaller Dimensionair all components and connections are quickly and easily accessible.

In every way the Dimensionair provides you with constant accuracy and GREATER DEPENDABILITY, adaptability and service. That's why more and more inspection people buy it. Why don't YOU try it? Write or call us at our nearest office.

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Federal's solution to the cost of gaging:
Impartial Gage Selection
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FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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How Many Teeth

The Schwartz generalization of too many teeth (*AM*—Nov 5 '56, p118), like all generalizations, is bound to be correct in part. As a rule to follow, it holds no water. As for the slab mill operation used in the Purdue tests, when is a high-speed slab mill justified today for milling a flat steel surface? If a carbide mill of proper diameter, say 4 in., were specified, would the rule of fewer and fewer teeth down to a fly cutter hold true? What becomes of tool life when the chip thickness is increased from 0.005 in. for the 12-tooth cutter to 0.060 in. for the fly cutter, especially with HSS tools? If a run-of-the-mine milling machine were used, and not a spanking new one, would the fact that, in reducing the number of teeth, the point is shortly reached where there is only one blade in the cut at a given instant have any effect on the results? The decrease in

SHOPMATES

N. Jarvis

ANY REASON WHY THIS PIECE SHOULD BE UNDERSIZE? WELL? SPEAK UP MAN! YOU MADE IT DIDN'T YOU?
YOU MAKE ONE LITTLE BOO-BOO AND THE WHIP TELLS YOU ABOUT IT LOUD AND LONG.
WHA.. PER.. WELL I.. ER... THAT IS...
THEN YOU TURN OUT A GOOD - REALLY GOOD JOB AND HOW DOES HE TELL YOU? IF HE TELLS YOU, THAT IS.
OH-BY THE WAY! GOOD JOB ON THAT-.. HEM.. GOOD JOB.
HUH? WHAT? WHO SAID.... ? I HEAR LITTLE VOICES ... SOMEBODY TALKIN?

How **IBM** handles precision drilling with *Leland-Gifford* Drilling Machines

How many holes in a business machine? It would take an IBM data processing machine to figure the answer.

Hundreds of parts in a complex statistical machine require holes precisely located, sized and finished. Major parts such as base plates, punch plates and support brackets have dozens of holes which must be drilled, tapped, spot faced, reamed or counterbored.

As you can see, IBM relies on versatile Leland-Gifford drilling machines to handle their drilling operations. Multiple spindles provide the right tools for the job in the right sequence and combination. Centralized controls and built-in safeguards against costly errors speed work flow, help keep costs low and quality high.

Always preferred for precision drilling, today's Leland-Gifford machines offer more in performance, economy and efficiency. New bulletins describe the latest time-saving, cost-cutting features. Write for them.

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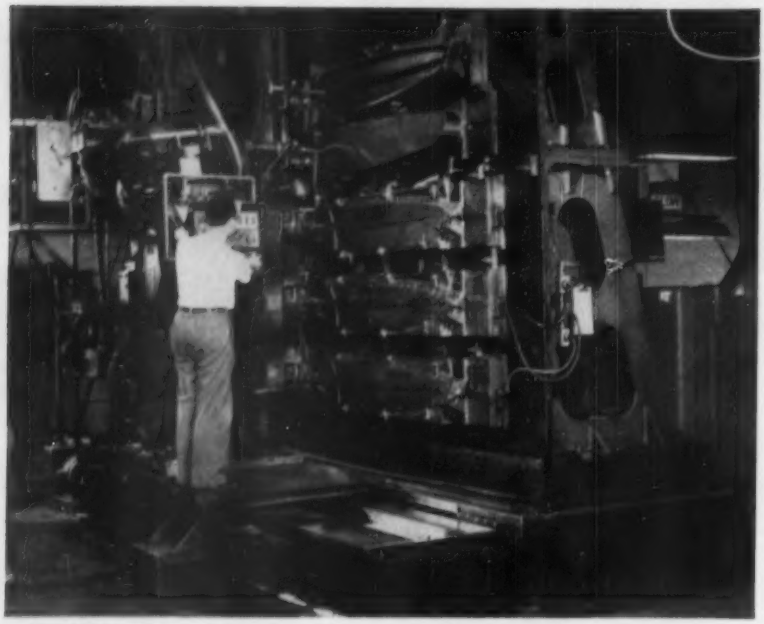
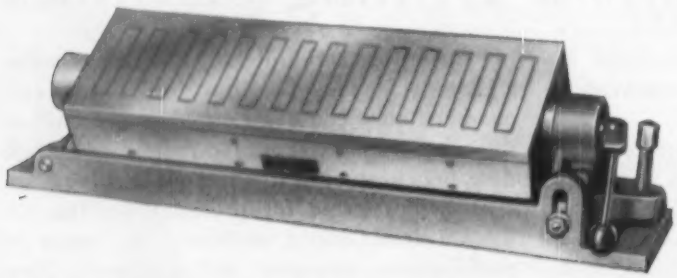
Walker Does it Again -



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.



AND—A Walker Permanent Magnetic Swivel Chuck—a type heretofore limited to Electro Magnetic Chucks. Another one of many applications by Walker.

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

IN CANADA—UPTON BRADEEN & JAMES, LTD.

power with the increase in chip thickness is extremely interesting and alone justifies a series of runs that smell of the laboratory. What is the explanation for this decrease? How about a dissertation on the effect of chips, their formation and removal, on horse power with varying numbers of teeth?

On the subject of chips—and none is more important to the metal removal artist—the Begle article on the milling of Titanium (*AM*—Nov 5 '56 p167) is excellent because its hews to the line—the all important line of chips and their influence on metal removal.

Finally, the announcement (p180) that ASTE has contracted with Batelle to evaluate metal cutting can mean much or nothing to those of us in the field of metal cutting. If it tackles the problem on a production, shop, level, much good can result. A suggestion: Look for vibration as the underlying cause of tool failure which, whether in terms of short life or breakage, is the ultimate criterion for the shop. And vibration is not only to be sought in the machine and workpiece, but also in the tool. Tools of the future will have dampeners built into them to eliminate or at least reduce the induced and inherent vibrations in tools. Something can be done by the machine tool builder and, up to a point, something can be done by properly holding the workpiece to reduce and control vibration—the deadliest enemy of our modern cutting elements, such as carbide, ceramics and the cermets. But in the tool itself, we have been building and using tools that are perfect violin strings for high frequency vibrations. That is being remedied; and with it a whole new world of metal removal opens before us.

Horace Frommelt
Consulting engineer
Philadelphia, Pa

Old Friend

I read with considerable interest your article, "Cammed Contour Boring Bar Cuts Cutting Time 1/3" (*AM*—Sept 10 '56, p122) because I am the original designer of the boring bar in question. Yes, I worked at Dixon, and now I work for the Hughes Tool Co.

The bar design came about in this wise. It was the second program at Dixon, a program which consisted of finishing gun tubes

for an 8-in. howitzer, as well as casting and rough machining tubes for 76-, 90-, and 105mm gun tubes. We had several Lo-Swing lathes which turned the OD's of these small gun tubes with cam-controlled tools, and it was this that gave Mr. Ellison an idea which he suggested to me. He was our chief engineer and is now head of Process Engineering at Hughes.

Our problem was to machine the powder chamber in the 8-in. gun tube. I laid out the pack boring bar and step boring bar, and the reamer bar which had been used to bore the powder chamber on the 155-mm. But before we made any of them, even before the layouts were detailed, Mr. Ellison came to me with the suggestion of adapting the cam-controlled tool idea of the Lo-Swings. So I designed the boring bar. Not just like that, of course. There were actually three complete layouts before I was satisfied, and Mr Ellison approved.

The breech-end taper was quite steep, while the muzzle-end taper was much flatter and longer. First, the breech-end taper was hogged off. Then that tool was replaced with a boring tool with its cutting edge on the opposite side. The tool was run to the forward end of the boring bar, the bar was pushed back into the gun tube, and the tool was pulled out. I repeat, "pulled out" in the direction of the arrow. This was the roughing cut. A finishing tool was then put into the bar and the process repeated, again by pulling the tool out. The finishing tool for one tube was used as the rougher on the next tube, so we machined two tubes per grind.

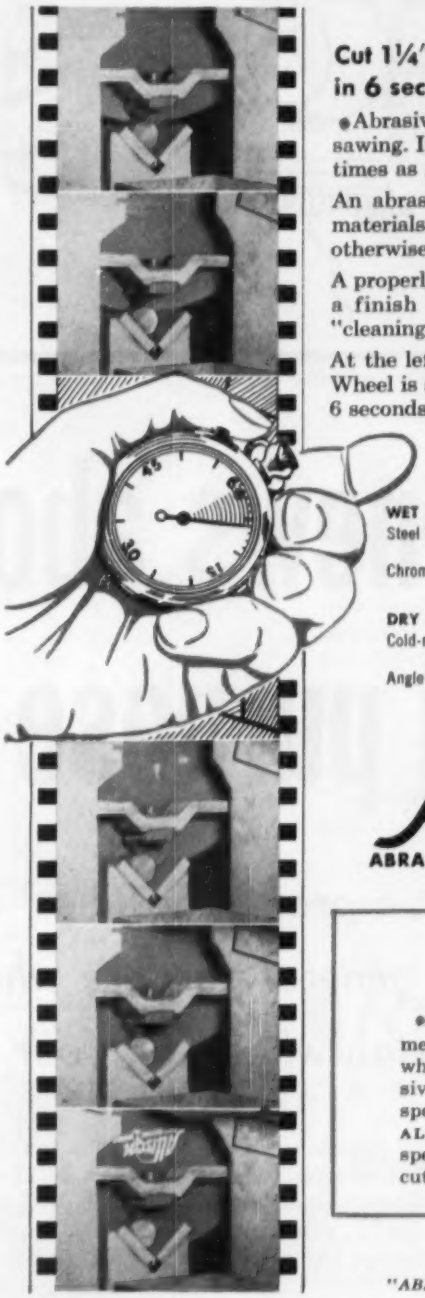
The figure of 1/3 time saving was true in this case. I believe it required 16 hr per chamber originally, and we managed it in about 5½ hr. The reason for pulling the tool out was to prevent distortion, which proved on trial runs to be as much as 0.040-in. bulge. The finish obtained was so good that the grinding operation was largely done away with.

You can see why I was interested in the article and understand my pleasant surprise when I recognized my design. The war and my 15 months at Dixon seem a long time ago, yet I see this design is still current. You might convey my regards to Mr E J Englis, who wrote the article.

Charles H Griswold
Houston, Texas

Abrasive Cutting | *the best way to cut many materials the only way to cut some*

Allison Cut-Off Wheels



Cut 1¼" Bar Stock in 6 seconds

•Abrasive wheel cutting is faster than sawing. In many cases it is ten to twenty times as fast.

An abrasive wheel will cut the hardest materials with ease. No need to anneal or otherwise prepare material for cutting.

A properly selected abrasive wheel leaves a finish which requires little, if any, "cleaning-up" operation.

At the left an ALLISON Abrasive Cutting Wheel is shown cutting 1¼" bar stock in 6 seconds per cut.

HOW'S THIS FOR PERFORMANCE?

	Cutting Time
WET CUTTING	
Steel Bar....8" dia... Rotary-type machine.....	320 seconds
Chrome Steel Bar.....4" dia... Oscillating-type machine..	105 seconds
DRY CUTTING	
Cold-rolled Steel Bar..1" dia... Chop Stroke-type machine..	2 seconds
Angle Iron.....1" x 1" x ⅛"... Chop Stroke-type machine..	2 seconds

Allison ABRASIVE CUTTING WHEELS

It pays to consult a specialist

•Profitable abrasive cutting means using the right abrasive wheel...and the proper abrasive cut-off machine...for the specific job. Why not let an ALLISON abrasive cutting specialist check your hardest cutting job?

Send for Booklet "ABRASIVE CUTTING" today

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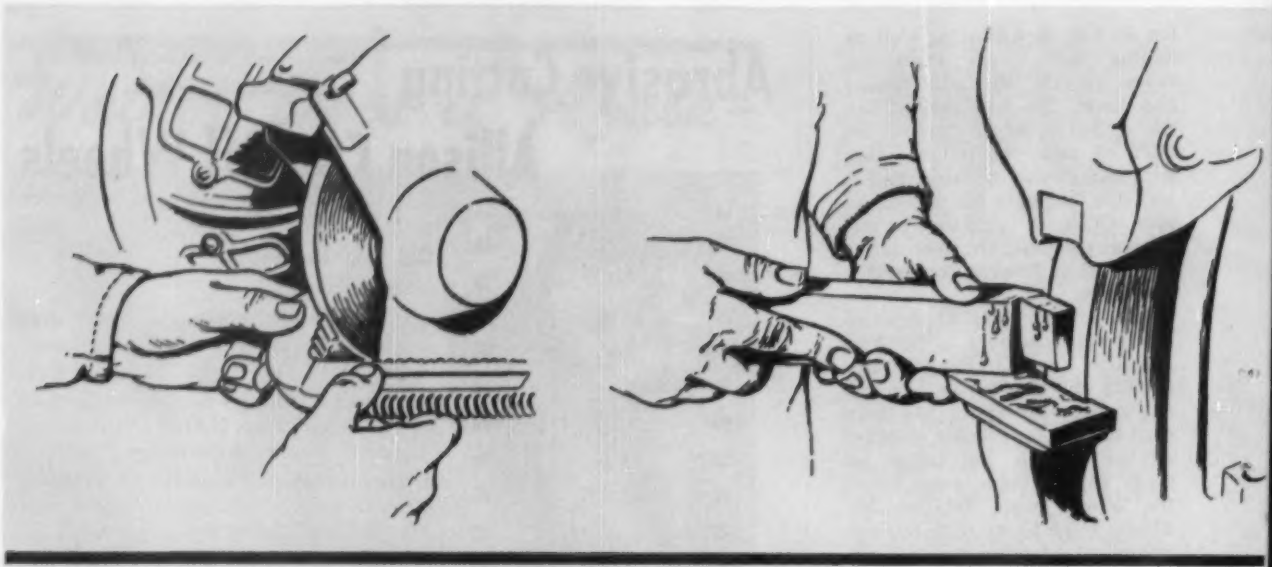
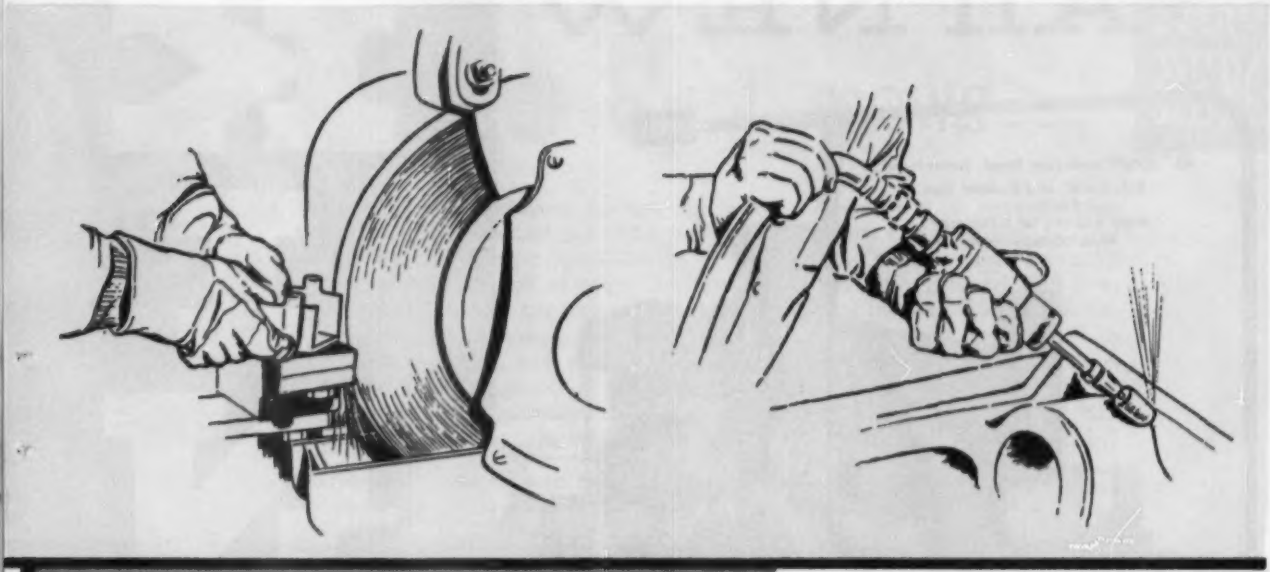


Great news about your general purpose grinding

You get the same profit-boosting "TOUCH of GOLD" from Norton general purpose wheels—as you do from the Norton wheels on your production jobs

Remember this about your general purpose bench and floor stand grinding, and mounted wheel operations . . . *Norton builds wheels that save you the most time and money across the widest range of grinding jobs* . . . whether it's a lowly bench stand or a high production, high precision grinder.

This includes wheels in every abrasive-and-bond combination you need, for every type of grinding. In particular, 44 ALUNDUM* abrasive is the new, revolutionary Norton development that's tops among all non-premium priced aluminum oxide abrasives. It's a proved fact that tough, versatile "44" wheels are now solving plenty of grinding problems for new users — with outstanding performance for less money.



So easy for you to get

Your Norton Distributor, one of over 315 in the United States alone, is your contact with the largest, most efficient service and supply system in the entire abrasive field. He'll give you fast deliveries on the wheels you want. And you get more good service by asking him for details on how Norton wheels — including the 44 ALUNDUM abrasive newcomers — will bring the product-improving, profit-boosting "Touch of Gold" to every one of your general purpose grinding jobs.

Ready for you — and full of facts and prices

This latest Norton wheel catalog brings you plenty of information and recommendations on the types of wheels that will give you best results in your particular grinding jobs. List prices are there, too — and also included is a brand new supplement covering discount net prices for the complete line. Get it now from your Norton Distributor. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

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All NEW

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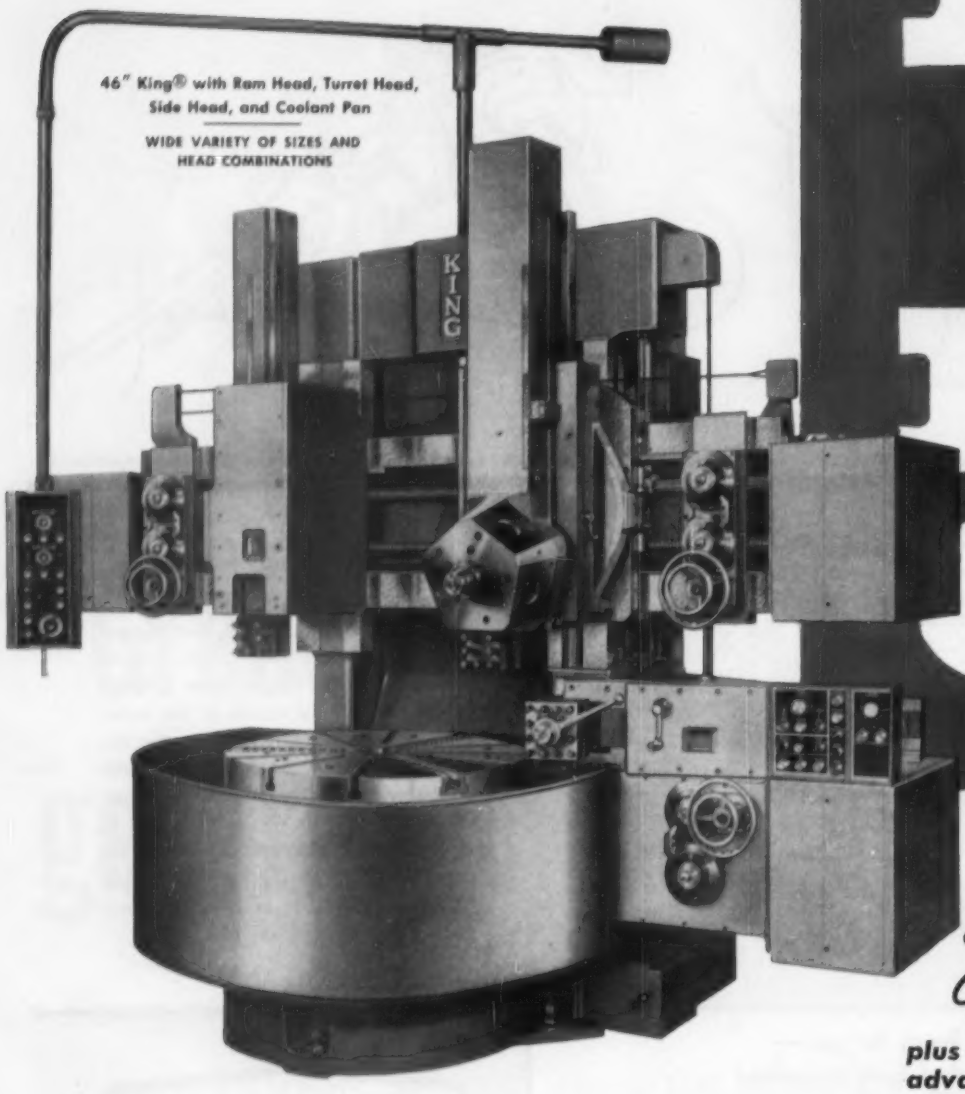

46" King® with Ram Head, Turret Head, Side Head, and Coolant Pan

WIDE VARIETY OF SIZES AND HEAD COMBINATIONS

Full Electrical Operation

plus many other advanced features:

INCREASED HORSEPOWER
40 to 50 H.P., on 30", 36", and 46" sizes, 75 to 100 H.P. on sizes 56" and up.

EXPANDED FEED AND SPEED RANGE
24 feeds from .0016" to .250" per revolution. 24 speeds in any one of three standard ranges —low, intermediate, or high.

AUTOMATIC LUBRICATION

OUTSTANDING NEW SPINDLE AND SPINDLE MOUNTING
—provides maximum table stability.

COMPLETE ELECTRICAL CONTROLS
—conveniently located on movable pendant and fixed-mounted side head panel.

DIALS FOR PRE-SELECTION OF FEEDS & SPEEDS

MACHINE ADAPTED FOR OPTIONAL ADDITION OF:
Automatic positioning of heads.
Automatic cycling.
Power rail clamping.
Power indexing of turrets.
Automatic tracing control of heads.

Q. What will it do for you?

A. Give you the greatest productive capacity ever achieved for your vertical boring and turning work!

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KING **VERTICAL BORING & TURNING MACHINES**

NEWS REPORT

Spot news...

- **Those Hungarian refugees are proving to be a boon to U S metalworking.** Somewhere between 200 and 300 a day are coming into Camp Kilmer, N J, by plane from Europe. Of these, nearly 90% are young, single men technically trained in some branch of heavy industry. To date, a large proportion of electrical and mechanical engineers, technical students and trainees, skilled machinists and tool and diemakers have turned up, have been eagerly grabbed off by plants coast to coast, with prospective employers even sending planes and buses for them. Major employer to date: Ford Motor Co. Interested? Write or phone Fred Schoenborn, United States Employment Service, Building 2113, Camp Kilmer, N J. Telephone: CHarter 2113.

- **Pontiac may have its own body shell by 1958,** it's being hinted around Detroit. Pontiac now shares the GM "A" shell with Chevvy.

- **Semi-automatic system for controlling forging press operations** is being researched in England. It works this way: slave potentiometer linked to a preset control unit controls length of each stroke, which can be carried out at full speed.

- **Optical tooling is currently in such tremendous demand,** now that it's been widely adopted by the aircraft and machine tool industries, that it is being rushed off the production lines still "warm."

- **Evidence that the Florida metalworking boom is on:** one top West Coast guided missile outfit has reportedly bought out a Cocoa Beach, Fla, motel for emergency employee housing when and if it moves in down there.

- **Ford turned out a record 8542 cars and trucks in a single day recently** in its efforts to lead the auto production race. Ford is working as much as 35% overtime, is moving its Thunderbird assembly lines out of the Dearborn plant to make room for increased output of standard models.

- **Ultrasonic non-destructive testing of structural adhesive bonds** (see p122 of this issue) is described in a just-issued government report, "Development of Non-Destructive Tests for Structural Adhesive Bonds," (PB 121495), Part 4. It is available at $1.25 a copy from OTS, U S Dept of Commerce, Washington.

- **First powder-metal bearings with built-in graphite** are now available here in simple slug shapes. Made in Germany, their best application is for high or low temperature, or where oil contamination is a problem. Bearings have high corrosion resistance and long life, plus good starting action.

- **Gas-lubricated bearings for industrial machinery are a possibility, too,** if current British research works out. Gas under pressure replaces conventional lubricants in separating one bearing surface from another. A wide range of gases could be used, as well as a variety of pressures and temperatures.

- **Molybdenum is being used to bond thin steel coatings to aluminum,** a development that may lead to lighter aluminum engines than hitherto believed possible. A thin layer of moly eliminates all need for a mechanical anchorage between the aluminum and the steel coating.

Spot index to major News stories...

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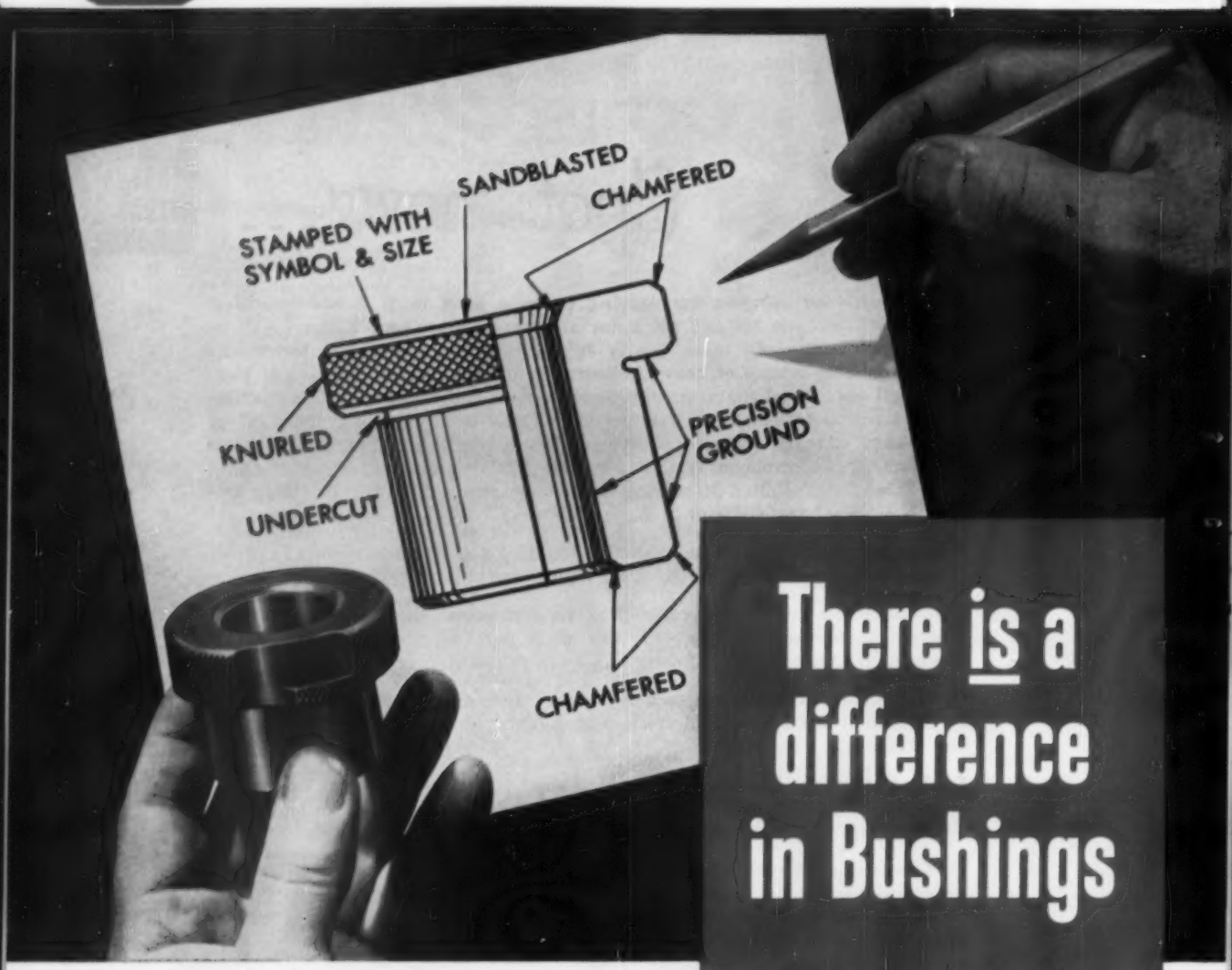
TURNING MACHINES

Automatic tracing control of heads.



There is a difference in Bushings

And here's what it means to you . . .

Recent tests in drilling 16,300 holes prove beyond doubt there's a difference in the wearing quality of bushings. Ex-Cell-O Bushings lasted twice as long as all other bushings in the test.

There's a difference, too, in accuracy and uniformity of hardness—brought about by automatic control of furnace temperature, time in the furnace, and quenching technique.

These differences make Ex-Cell-O the leader: (1) High chrome, high carbon oil-hardening bearing steel is used for long wear. (2) This steel is uniformly heat treated to 62-64 Rockwell "C". (3) Bushings are precision ground on inside and outside diameters, and under the head for perfect seating. (4) Besides measuring up to A. S. A. standards, bushings must meet Ex-Cell-O's own standards for precision.

Large inventories in Detroit, Los Angeles, New York, Lima, Ohio and London, Canada, keep your inventory down. You get "same day" shipment.

Write for an Ex-Cell-O catalog today.

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56-56

Washington ... NEWS REPORT

New military missions . . .

Metalworking firms with defense contracts will feel the impact of Defense Secretary Wilson's recent order clarifying service roles and missions and the operational responsibility for certain guided missiles.

The effect will be in terms of new production contract awards, adjustments in research and development projects, and procurement procedures.

In brief, the Wilson order limits the Army to anti-aircraft missiles with ranges under 100 miles and land-based ballistic missiles under 200 miles. The Air Force gets control over the longer-range land-based missiles. The Navy's missile projects stay as is. In addition, Wilson ordered a cut in the size of the Tactical Air Command—fighter-bombers, close-in day fighters, and troop carriers—mostly because of the increased capability of the Army's own tactical missiles like Corporal and Redstone. These have reduced the need for close-in air support for ground troops. The order also limits the Army's air arm to current plane sizes and functions—spelling finish to the Army's plan to expand its own aviation.

Right now, cancellations or cutbacks of existing production contracts seem unlikely. But this much seems certain: future orders for planes like North American's F-100 fighter-bomber and its F-107 successor, Lockheed's F-104 supersonic fighter, troop-carrier aircraft, and Army-type planes like helicopters and small fixed-wing aircraft will now be much smaller than originally planned.

So will orders for replacement parts and equipment for planes now becoming obsolescent—like Republic's F-84F and North American's F-86—and components for the newer fighter-bombers.

Shifts in missile development . . .

Starting next July 1, two of the big costly missile development projects will be financed by different services because of the clarification of military missions. This will mean a switch in military contracting agencies and procedures for some firms and make the future status of two projects somewhat uncertain.

The Air Force will take over the Army's Jupiter IRBM project, now being developed at the Army's Redstone Ordnance Arsenal. Scores of companies—notably Chrysler, North American Aviation, and Ford Instrument—are already making prototype assemblies and are lined up to handle future heavy-volume production.

Mobilization maintenance . . .

In the works at the Pentagon is a program to line up private industrial facilities—notably in metalworking—to handle depot maintenance of weapons and other military equipment during a future mobilization.

The plan will become part of the Defense Dept's Production Allocation Program, under which plants are lined up in advance to produce top-priority military goods in case of war or of full emergency mobilization.

Actually, some firms are already signed up in PAP solely for maintenance work. But the new program will increase the numbers of facilities involved—and also the types of military equipment. The new program is in line with the Defense Dept trend toward use of civilian contractors to maintain military equipment—stemming from the increasing complexity of new weapons and the shortage of skilled technicians in the services.

Capital spending still up . . .

Expenditures for new plant and equipment are still going up. That's what the government's latest survey of capital spending shows. (For McGraw-Hill's new report on industry's capital expenditure plans, see p154). Industry reported that it plans to spend $8.7 billion in first quarter 1957. Adjusted for seasonal influences, this is an annual rate of $37.96 billion—$3 billion over the record-smashing estimate reported in the McGraw-Hill survey for 1956.

But there's a cautious side to the outlook: the rate of growth is slowing down. For the past half-year, industrial expansion has been less than in the same period last year. In 1955, the third quarter rang up a $2.46-billion gain, at a seasonally adjusted annual rate, and the fourth quarter showed a gain of $1.8 billion.

This year, the third quarter showed an increase of $1.38 billion; fourth quarter estimates indicate a rise $1.46 billion. The gain estimated for first quarter 1957 is even lower, $630 million. On a total annual basis, the 1956 capital spending estimate is now $34.9-billion—$800 million under the figure estimated in June. Government experts believe steel shortages, credit stringency, and rising costs are to blame.

But Washington isn't worrying yet. There's no sign that expansion plans are being cancelled because of lessened confidence in the future. Everything still points to further gains for capital spending.

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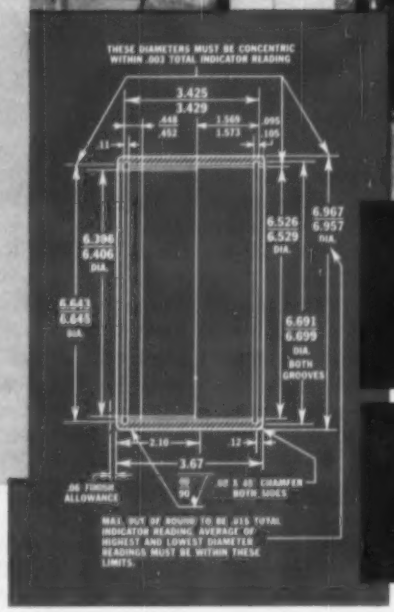

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Detroit ... NEWS REPORT

Fuel injection is here . . .

"We'll have fuel injection on our cars by spring" is the announcement American Motors made at the 42nd National Auto Show in New York. It's an announcement that will have far-reaching effects on the metalworking industry, because fuel injection means industrywide drastic tooling changes.

While first introduction of fuel injection rightfully goes to Chevrolet, Chevvy's model is a costly one (price tag runs somewhere above $480), and many experts think it's unsuitable for anyone but the racing car devotees who scramble around hay-lined courses in Corvettes.

To date, American Motors hasn't announced a price on its Bendix fuel injection system, but it's expected to run somewhere between $200 and $250. First installations will be on the Rambler Rebel.

If this catches on and other auto firms adopt the Bendix system, the price could come down a lot. Pontiac also introduced a fuel injection system at the New York show, but the system, which is made by GM's Rochester Products Division and is somewhat similar to Chevrolet's, is designed for a special sports car, the Bonneville Special, and won't be available on other Pontiacs for some time at least.

Ford is not lagging behind either. In fact, it has been testing fuel injection ideas for years, has come up with no less than five separate systems—all of them good. Some are mechanical, like the Rochester product, and some are electronic like the Bendix. But Ford doesn't want to put fuel injection into any of its 1957 models as a running change, preferring a "wait and see what happens" attitude.

Chrysler, which has gone all-out on a turbine program, also has at least one fuel injection system in the works, probably mechanical in nature. If customers put the pressure on, Chrysler will undoubtedly introduce it as a running change. But Chrysler won't be at all happy about it because of its turbine trend—Chrysler is a lot closer to turbine output than it cares to have anyone think, insiders say. And they're turbines that don't use critical metals and are produced by investment casting.

GM, in addition to its Rochester Products fuel injection system, is said to be readying one similar to Bendix's electronic job. Thus GM can enter the market with whichever system goes best, or it can come in with both types.

Over at Studebaker-Packard, there's no indication that fuel injection will come in at all on the '57s. But Curtiss-Wright's current negotiations with Germany's Mercedes-Benz indicates that S-P will have German fuel injection within a year or two at most.

What does it mean to the trade?

It means tooling—fuel injection's electronic systems require entirely new manifolds, and a lot of additional drilling and major changes on the engine block. Not only that, mechanical fuel injection systems require additions to intake manifolds, plus some block changes.

Not one automaker to date has tooled up for mass production of fuel injection systems for existing models, with the possible exception of Chevrolet, which is turning out 200 or so a month.

Best summation of the effects of fuel injection on the auto industry comes from talks with engineers and sales people. Said one veteran of the Detroit automotive wars, "Chevrolet brought out a fuel injection system that could only interest the belt-in-the-back-of-the-beret racing set. AMC, bless them, have set the whole industry to bustling around. Now the big boys have got to shake a little of their fat and figure out ways and means to beat each other. There's nothing like competition, and nothing healthier than AMC's Romney or S-P's Churchill throwing the snowballs that knock down the silk hats."

Don't overlook Willys . . .

Usually written off in the auto statistics books, Willys Motors Inc is still very much alive, and healthy now that it's completely divorced itself from passenger car manufacture.

Willys is sitting pretty on a $5-million nest egg made this year—is looking eagerly at an ever-expanding market for special truck bodies built on to the famous Jeep.

Willys, which does 60% of its business overseas, has laid out an ambitious program of expansion in the trucking field—planning periodic introduction of new models, and an outlay of $2-$3 million for tooling this year alone.

The sales picture . . .

. . . is currently very good and is expected to stay that way the rest of the model year. All told, December car output should hit somewhere around 610,000 units. Current front runner in the passenger car race for the first model month is Ford, with Chevrolet lagging just a little behind at 38,000 units a week.

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NEWS REPORT

Machine tools...

Good times ahead . . .

Good news has been coming out of the machine tool industry. Order volume has been substantial, backlogs are hefty, and production is at the year's peak.

Cincinnati Milling's output this year will be above $145 million, its unfilled orders add up to $113 million (compared with $107 million at midyear and $90 million at the start of 1956). Outlook is for operations to continue at full capacity next year.

An important midwest builder was compelled to turn away as much business as it booked during November because its backlog already extends a year ahead or farther. Another company reports a year's accumulation of orders for special machines and six months for standard tools. It says the 1957 prospects "are extremely good."

Why sales will be good in '57 . . .

Warner & Swasey anticipates high sales for its machine tools next year on the basis of: 1) increased aircraft buying, 2) demand by electrical equipment makers, 3) purchases in the southwest by new plants and by oil field equipment shops, 4) requirements of road machinery manufacturers, and 5) needs of general manufacturing plants.

Incoming orders at National Acme are continuing to match shipments, pretty well assuring a year ahead on a par with this year, which is up 25% from 1955.

Monarch Machine Tool's unfilled orders are 20% higher than at the beginning of the year. Currently, orders and shipments are about on a par with each other. Monarch's output this year will total $17 million.

A prominent builder reports November orders 50% above October's (but way off from August, when buyers were rushing to beat a price increase). The company could sell more machines if it could make more. Production is being pushed hard, and backlogs average 10 months.

Not all builders are optimistic about the first quarter. A few expect a downturn, naming the tight money situation as mainly responsible.

India to build U S machines . . .

Production of standard general-purpose American machine tools is likely to begin in India before long. Four representatives of three private companies in India recently spent two-and-a-half weeks visiting 15 selected machine tool builders in this country. They were accompanied by John Elliott, who is technical advisor (Machine Tools) to the Ministry of Commerce and Heavy Industry of the Government of India. Mr Elliott formerly was with the Cross Co.

The Indian delegation is taking back half-a-dozen prospective agreements, each with a U S builder, providing for technical collaboration in manufacture of U S machines in privately-owned Indian factories.

On their way back home, the Indians are taking three weeks to visit machine tool builders in the United Kingdom, Germany, Italy, France and Switzerland.

They hope to reach agreements with European builders similar to those with U S companies.

Navy has new replacement formula...

A Navy machine tool replacement formula for use in fiscal 1958 (beginning next July 1) has been approved by the Assistant Secretary of Defense for Supply and Logistics. It already has been sent to Navy bureaus for comparison reports on operating costs of existing tools versus new ones.

The new formula is a modification of the MAPI formula. It differs somewhat from the plan set up last year by the Navy's Bureau of Ships.

It emphasizes factors peculiar to Navy operations. Items like labor, maintenance, spoilage, power, scrap and reworking get an important play. Taxes, insurance and floor space on the other hand, are played down in computing costs.

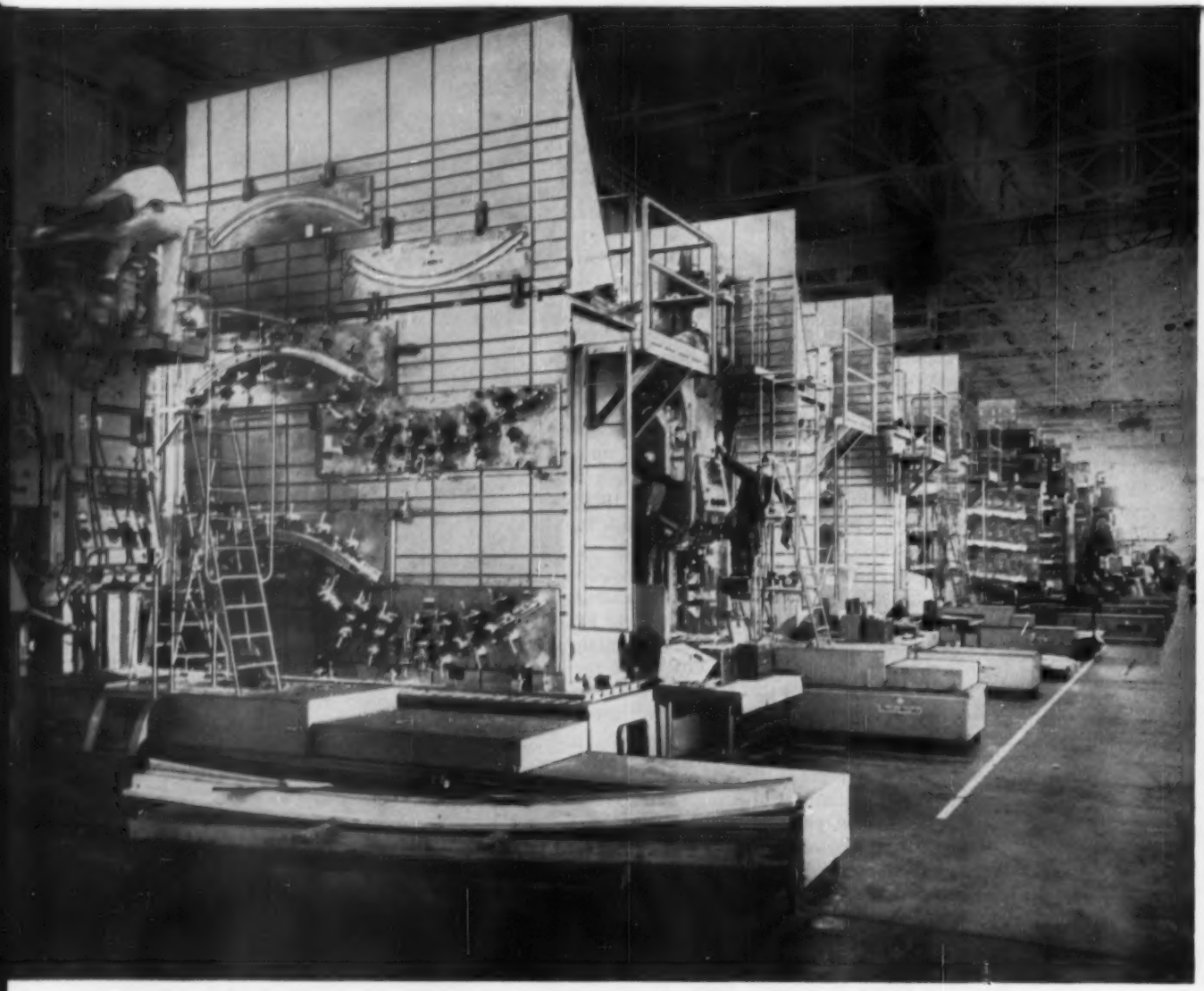
Navy installations are usually not in full production during peacetime, hence floor space utilization is not regarded as important as in private industry.

Operating cost figures will be determined under the new formula by detailed studies of production needs for military end items rather than by predetermined estimates of anticipated production.

Costs will be figured out by the production men in the using facilities. No two machines thus are likely to have the same set of figures.

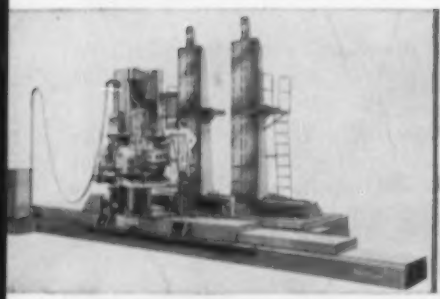
Bureau of Ships, meanwhile, has revised its instructions about figuring production equipment replacements, based on its experience with the formula developed last year. The revised instructions will be put into manual form in time for use in fiscal 1959.

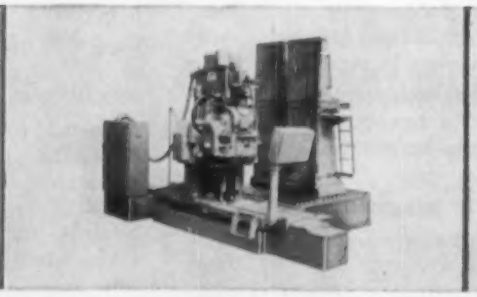
BF

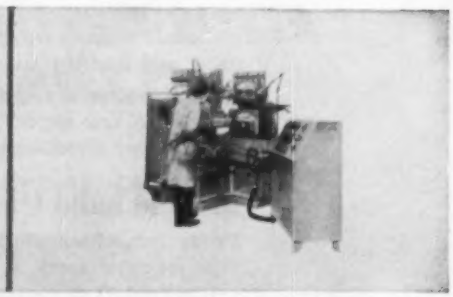


GIANT

shape the future







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The use of two and three-spindle KELLERS provides rapid output geared to tight schedules. One noted manufacturer is counting heavily on KELLERS to help produce 150-foot airliner wings on a five-a-month basis and fill $90 million worth of orders.

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NEWS REPORT

What's ahead ... in Metalworking

New peak in first quarter . . .

Metalworking production promises to be at a peacetime peak during the first quarter of '57. There are good reasons for predicting record-breaking operations.

Capital goods backlogs are so tremendous that most machinery builders will be working two shifts, with many on an overtime basis.

What's more, incoming business still is very high in volume and probably will continue so.

Tools, supplies and equipment ordered by industrial distributors (normally an excellent barometer of production rates immediately ahead) have been so great that the present volume was surpassed only during the Korean build-up, the American Supply and Machinery Manufacturers' Association reports.

Recovery in new orders, in fact, has been sharp and decisive the past four months, completely reversing the fall-off at midyear.

Bookings by gear makers have shot up, with a 30% increase over the previous month. Industrial furnace sales were 27% better in the first 10 months of 1956 than in the same period a year ago.

Auto production swings up . . .

Automobile manufacture should show a nice gain in the first quarter. General Motors president Harlow Curtice predicts production of 6.5 million passenger cars (a 10% gain over this year) and 900,000 trucks during 1957. Total assemblies for U S and Canada should hit 8.3 million, against 7.4 million in '56.

Farm equipment industry, one of the chief soft spots in the national economy, believes things will be somewhat improved next year. Farm prices are much better, the government's program for agriculture has been spelled out, and farm cash income should be higher. Inventories of tractors and farm implements in dealers' hands have been substantially reduced.

Main deterrent now is the prolonged drought which has continued for months in many areas.

Diesel-electric locomotive orders have backed up to the point where certain builders are forced to promise long deliveries. No improvement is expected for some time. Freight car makers are limited by the amount of steel they can get. They think that 1957 will be a banner year.

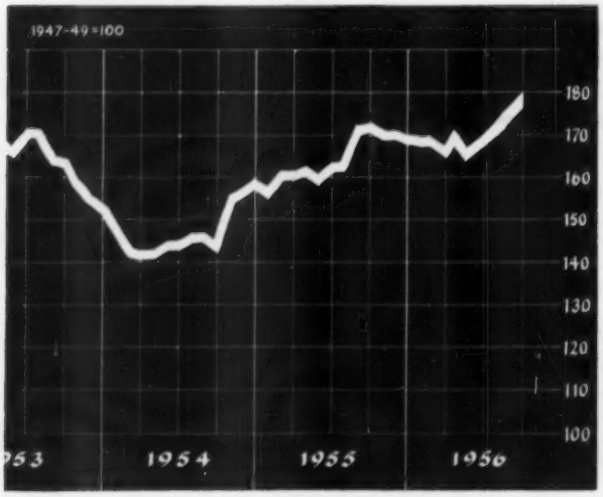
Pipe, plate and structurals tight . . .

Steel mills will run virtually at full capacity in the first quarter. Nevertheless sheet, strip, carbon bars, cold-drawn bars and stainless are in good supply right now. The ready tonnage of sheet is traced to the failure of the deluge of automobile orders to develop. Detroit orders have been hefty, but still not in the quantities anticipated.

Pipe is tight, from that used for water lines by plumbers to giant oil-country items.

Even tighter in supply are plate and structurals, with no letup in sight. A tanker-building program will make the situation worse.

Warehouse sales of reinforcing bars and wire mesh for concrete construction and roadbuilding are up 58% over last year.



180

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**180**	**178**	**176**	**174**
Machinery	156	157	145	
Electrical Machinery	217	212	207	
Autos	116	92	144	
Other Transportation	353	391	323	
Other Metalworking	150	148	145	

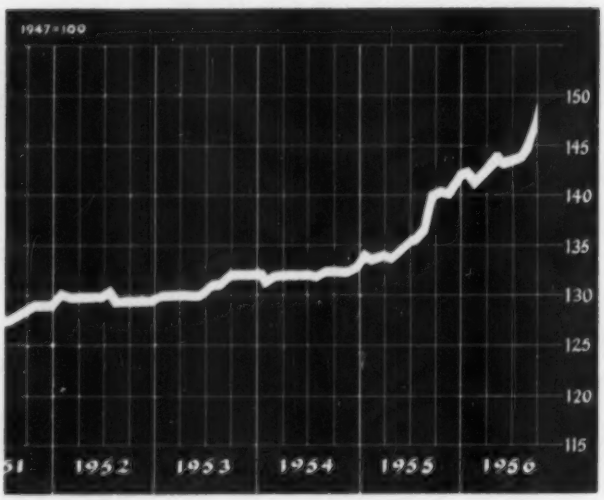
NEWS REPORT

What's ahead...in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**149.5**	**148.7**	**147.5**	**139.9**
Metalworking Machinery		**171.6**	**170.5**	**157.2**
Other Machinery exc. Electrical		**156.6**	**155.3**	**146.6**
Electrical Machinery		**149.1**	**147.8**	**136.8**
Fabricated Metal Products		**141.3**	**140.0**	**134.7**

149.5



Next year to be better than '56 . . .

Business activity is rising strongly, despite Suez and other international crises.

Next year promises to be considerably better than this year. And that is saying a lot.

Whether measured in physical output or dollar sales, 1957 will be a highly prosperous year for the economy as a whole and for most industries.

Gross national product should reach $435 billion, compared with $410 billion this year. Price inflation will be partially responsible, to be sure. But expect a growing volume of services.

Federal Reserve index of industrial production can be expected to rise to about 147 during 1957, as against 143 in 1956.

Contrary to the opinion of some observers, the second half of next year is likely to be better than the first half. It's a good bet that the final quarter may be the best of the year.

Next year should see a continuing gain in business capital expenditures, a fairly high level of home-building, some additions to business inventories, and an increased rate of spending.

If foreign troubles should exert any adverse effect upon the economy, any slack that might develop would soon be taken up by an expanded demand from defense and related programs.

Regardless of international developments, Washington will spend more money next year on various civilian programs. The soil bank plan for agriculture, and aid to states for highways and schools, are the most notable of these programs.

State and local governments are steadily adding to their construction work, with highway building scheduled to accelerate sharply in 1957.

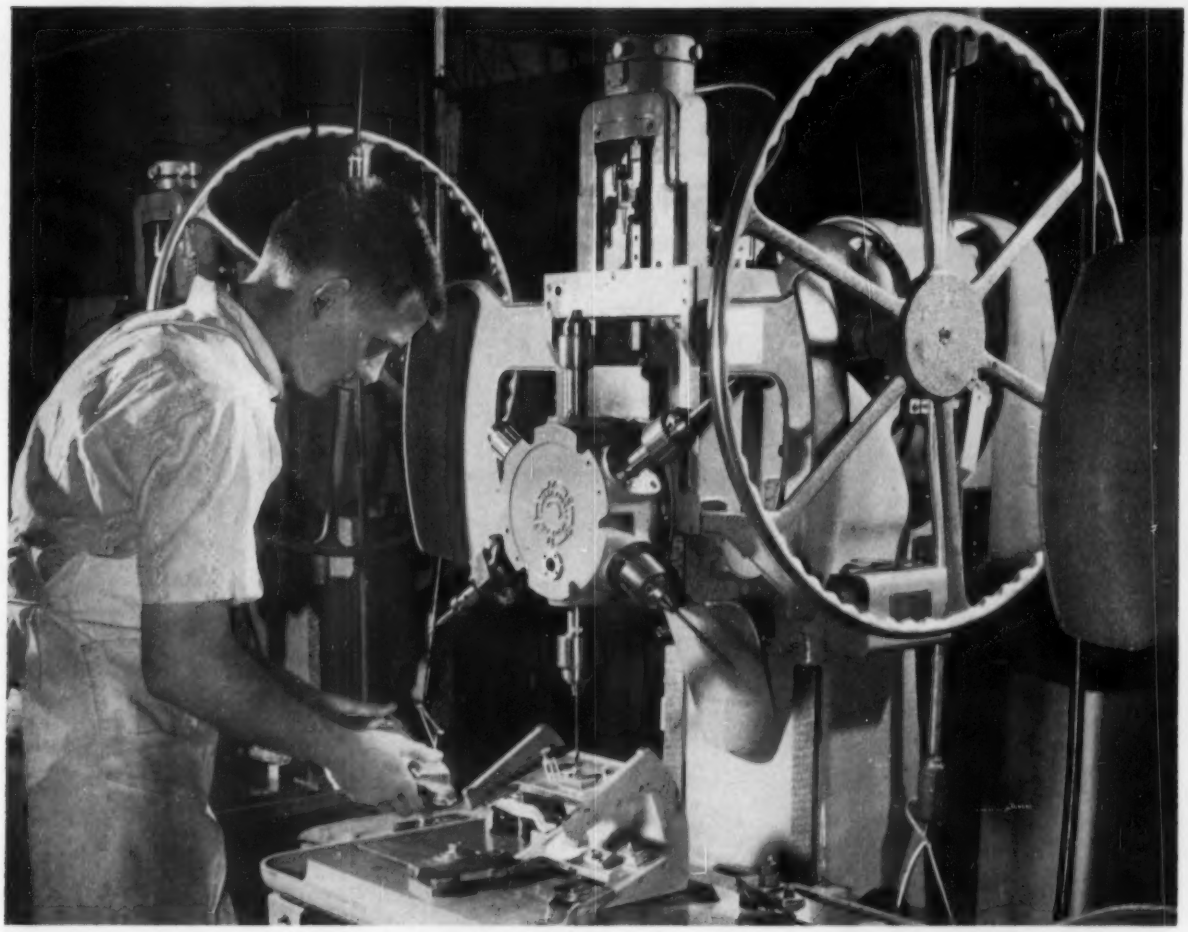
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	150.5	150.6	148.3
Steel ingot operation (thousands of tons)	2,473	2,489	2,416
Electric power output (million Kilowatt hours)	12,075	11,439	11,359
Production of automobiles and trucks	191,164	146,991	213,506
Engineering construction awards (Eng. News-Record—millions)	$323.3	$377.1	$330.3

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	145	145	143
Index of durable manufacturers' production (1947-1949=100)*	165	164	161
Durable goods manufacturers' sales, millions*	$13,730	$13,665	$13,692
Machinery manufacturers' sales, millions*	$ 3,941	$ 4,022	$ 3,474
Durable goods manufacturers' new orders, millions	$14,377	$15,166	$15,936
Machinery manufacturers' new orders, millions	$ 4,186	$ 4,195	$ 4,165

* Seasonally adjusted



BURGMASTER® turret drills increase servo actuator production 25%

Here is what they say at Parker Aircraft Company, Los Angeles:

"Our bank of five 6-spindle Burgmaster turret drills have replaced a large number of single spindle machines and on this job performed thirty operations with a production increase of 25%. Drilling, tapping, counterboring and countersinking was accomplished with one set up. Lightweight fixtures could be used and, with fixture clamped in alignment under the spindle, a higher level of quality was maintained with improved finish. Repair work dropped to a minimum."

Automatic hydraulic Burgmaster (6- and 8-spindle models) feature skip indexing, automatic cycling and infinitely variable pre-selective feeds. All models (including the 6-spindle manuals and radial) provide power indexing, pre-selective spindle speeds and very close pre-selective depth control.

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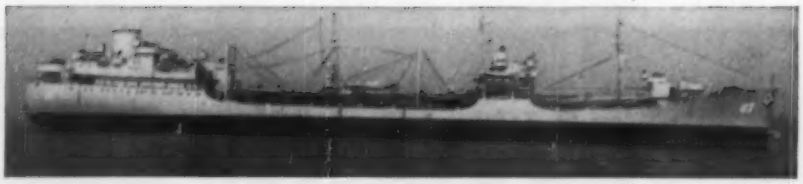
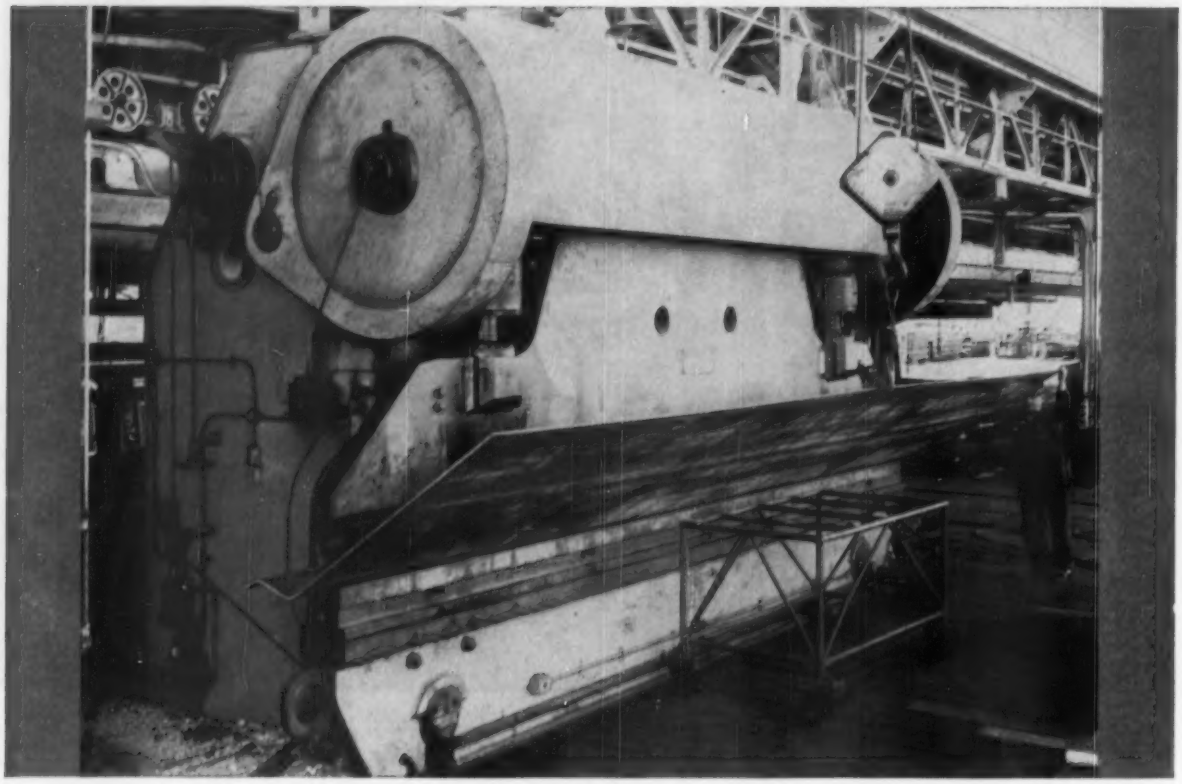


U.S.S. KASKASKIA is typical of many ships which have had extensive bulkhead and other repairs at Moore Dry Dock Company.
Official U. S. Navy Photograph

Moore Dry Dock SPEEDS MARINE REPAIRS



Fluted bulkhead plate being formed by Steelweld bending press in plate shop of Moore Dry Dock Company for bulkhead renewal job on U.S.S. "KASKASKIA" (A027). Size of plate: length 26', width 6', thickness ½".

Long a leading West Coast ship builder and marine repairs concern, the Moore Dry Dock Company, Oakland, California, has found a large Steelweld Bending Press to be a great asset in speeding the forming of heavy plate.

Ship repair, which constitutes an important part of the company's business, often requires replacement of large sections, such as bulkheads. This necessitates the forming of plates to various shapes to accurately replace those removed. Because of the power of their Steelweld and the ease of making adjustments, this work is carried on efficiently and satisfactorily.

The entire line of Steelwelds has an enviable reputation for continuous high-production performance. We urge you to get the facts on their many outstanding features.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Why 1957 Looks So Good

The Hungarian massacre, the Suez crisis with the resultant desperate shortage of oil in western Europe, and the brink-of-war situation internationally have so dominated the headlines that the favorable economic outlook at home for 1957 has been obscured.

All of a sudden, however, we are confronted by some very pleasant news. Expenditures for new plant and equipment the coming year will set an all-time record, the McGraw-Hill Department of Economics reports. Its survey was made in late November and early December.

The survey figures confirm the growing belief that capital spending, which has been in the biggest and longest upswing in history, is heading for stability at a high level. Certainly no downturn is in sight.

Some $40 billion . . .

will be poured out in 1957 by American business and industry for new plant and equipment. That is a gain of 11% over 1956, which in turn has been 21% better than 1955.

Take only the manufacturing industries. Capital spending will amount to $14.4 billion. That is a healthy increase of 14% over the past year. What's more, steel and non-ferrous metals producers are near the top on the list of those who will make huge capital outlays. Metalworking has ambitious plans too. Industrial machinery and electrical machinery builders, to mention two groups only, are committed to spending more next year.

Higher prices obviously will help to boost the dollar volume of plant-and-equipment spending in 1957. But they do not begin to account for the entire gain over 1956. The physical volume of capital goods business will be up considerably.

The survey findings show conclusively that neither the national election nor the Suez crisis has had any significant effect upon the plans of business and industry for new plant and equipment. Interestingly, the amount of projected spending is 6% more than was reported last spring when a similar survey was made.

There is a logical explanation . . .

for this change on the plus side. The sum involved is just about equal to the planned spending for this year that was deferred until 1957 because of various delays.

The tightness of money is not expected to be much of a deterrent. The survey brings out the fact that if money is hard to get, managements tend to stretch out their spending programs rather than cancel them.

Inquiry about plans for 1958 gives support to the theory that capital spending is likely to be stabilized on a high plateau. About two-thirds of the companies surveyed plan to maintain their plant and equipment outlays in 1958 at the same level as in 1957, or to enlarge them. Keep in mind that as management predicts farther into the future, it becomes increasingly conservative. This fact lends even greater significance to 1958 estimates.

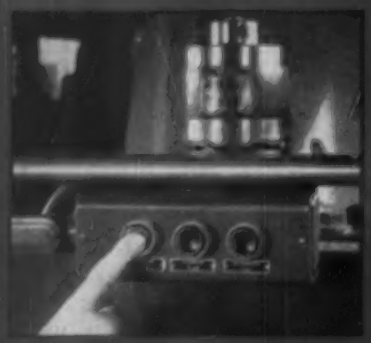
Free-flowing demand . . .

for capital goods was mainly responsible for Metalworking's rise in 1956 to a new peacetime production peak. The McGraw-Hill survey provides tangible evidence that the same powerful influence will be at work next year to help 1957 to surpass the past year's magnificent performance.

Burnham Finney EDITOR

Test cuts eliminated

by accurate performance of CINCINNATI Shears...



The Buttons that save time. The great time-saver—the Cincinnati front controlled Power Back Gauge.

Brown-Wales Company says:

"As a steel warehouse, we have comparatively few production jobs, however, we have found that our men with this new shear can turn out far more work in an hour or a day than they could with the old one. In the first place, the power operated back gauge is a great time-saver when changing, as we frequently do, from one job to another.

"Secondly—the greater accuracy of the shear has made test cuts unnecessary, so that down time between runs is greatly reduced."

Write for Shear Catalog S-7R.

Photos courtesy Brown-Wales Company, Cambridge, Mass.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

American Machinist

Here's how we designed an automated plant...

R L HILLER
Manufacturing Engineering, Medium Induction Motor Dept
GENERAL ELECTRIC COMPANY, SCHENECTADY, N Y

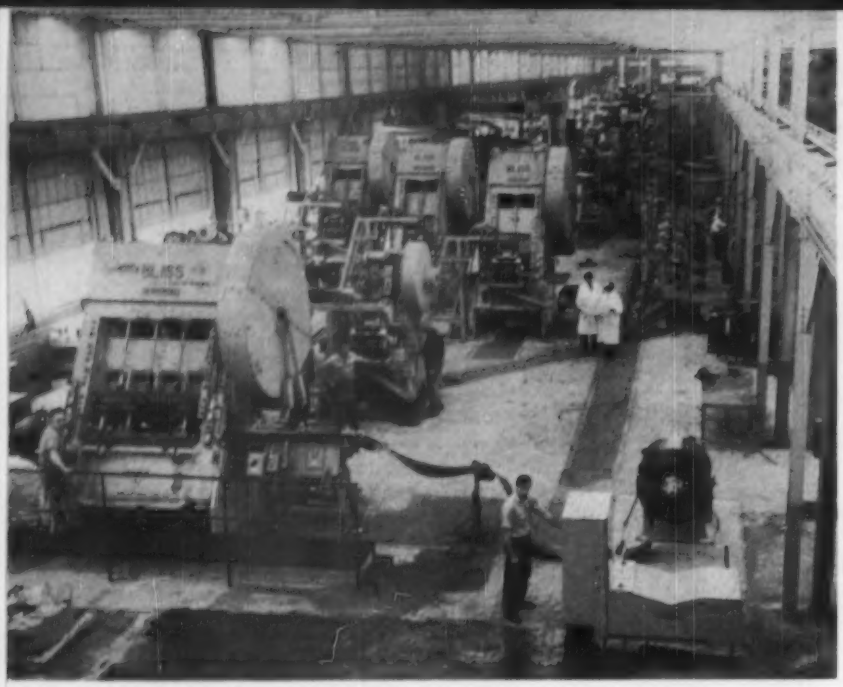
What was the thinking behind Building 85, the "most modern motor plant in the world"? Why were certain choices made? An engineer closely involved with the planning here gives a behind-the-scenes explanation of decisions on this $7-million plant, which produces 7½- to 30-hp motors on an automated basis, compressing a 2-week cycle into a 3-shift day

Automation is considered to be a philosophy of manufacturing—not a complicated machine. This concept was used when we built our new Tri-Clad* "55" motor factory in Schenectady (*AM*—Apr 23 '56, p 154; Dec 20 '54, p 110; April 11 '55, p 170).

Process flow was established by utilizing the principles of automation in tying together individual machines which were automatically cycled, thus achieving the four basic objectives which were our goal: improved service, greater mechanization of equipment, better quality, and larger, more-flexible capacity. A definitely timed integration plan of personnel, facilities, and operating procedures, controlled by certain major manufacturing concepts, was developed to obtain necessary improvements.

Straight-line flow of parts from coiled steel, used for punchings at the head of our production lines, to completed motors ready for shipment at the ends, has enabled us to produce motors at minimum unit cost without frustration in manufacture. The continuous-flow shop required advanced technological improvements usually thought economically prohibitive in low-quantity manufacture. However, review of cost ratios indicated that the continuous-flow shop was economically feasible when completely mechanized equipment was used wherever possible. This was deter-

* *Registered Trade Mark of General Electric Company*



Head-end press arrangement . . .
of a standard production line shows machine locations and absence of usual conveyors

mined by a task force which evaluated customer requirements in terms of our development, design, and value-analysis stages to attain a sound manufacturing plan.

WHY DUPLICATE PRESS FACILITIES?

For example, one may ask why punch-press operations were included in the new motor-manufacturing plan when other facilities were available in a separate, self-contained unit for the production of the required punchings. Basically, this was a clear case of economics. The use of available facilities required tremendous storage areas; uneconomic, static stockpiling of in-process inventory; non-productive material handling and an attendant for recording and bookkeeping. Inclusion of punch-press operations in the manufacturing plan eliminated these conditions.

QUIET AND FLEXIBILITY

It was also decided to install all equipment in the building on vibration-free isolators and to wire overhead. This holds noise and vibration to a minimum and gives flexibility to all our installations in case it ever becomes necessary to replace a piece of equipment because of a major breakdown.

Starting with two-dimensional layouts through to the final three-dimensional layout of the whole motor shop, plans were made, modified and revised innumerable times. New thoughts were introduced, production requirements and motor-size patterns were established, studies of the economics of low-cost, low-production equipment versus high-cost, high-production equipment were made, and the relative tooling costs for each were computed. Concurrently with these activities was the selection and placing of orders for equipment and tooling.

It was decided to divide the factory into three separate manufacturing lines. The standard production-line building motors from 7½ to 15 hp is on one side of the factory. The line building motors for 15 to 30 hp is on the other side, with the line making motors to customer specifications, or "special line," in the center of the building. Production of components for special motors progresses through the standard lines until a special part or assembly is called for. At this point, all components immediately are transferred to the special line where remaining operations are completed.

DRABNESS IS A HAZARD

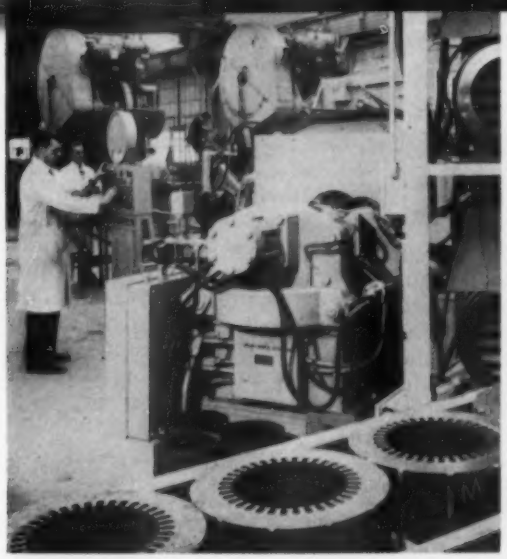
Drabness of surroundings is considered an industrial safety hazard. Thus, a great deal of attention was given to providing proper light and ventilation. Three distinct colors were applied to our equipment—a different color for each production line (see cover). This contributes towards more pleasant surroundings and creates an incentive for better housekeeping. Colors are, incidentally, buff for the 7½- to 15-hp line, light green for the 15- to 30-hp line, and bluish gray for the special line. All conveyors are light gray. In conformance with standard GE practice, all warning signs are red and white, aisle danger signs red and yellow.

Step-by-step operations in one of our production lines will be outlined to show how automation was incorporated in our manufacturing plan:

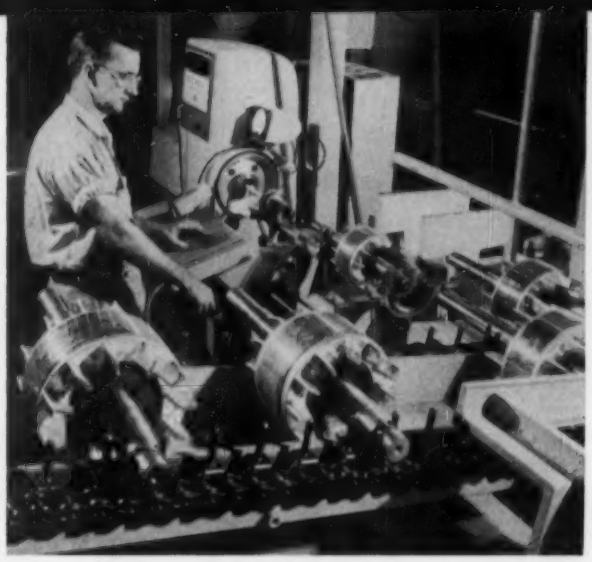
At the beginning of the 7½- to 15-hp standard line, coiled silicon steel is loaded by a crane on a movable coil car which runs on rails and positions the coil of steel on a de-reeler. The steel is threaded through a slide-feeding device which automatically feeds a 200-ton double blanking press. Blanks are transported via chutes and underfloor belt conveyors to the 90-ton separating presses where, by use of magnetic-lift belt conveyors, the blanks are raised and loaded into hoppers. Blanks are then fed automatically into a separating die where they are converted into rotor and stator blanks. At the back of the separating presses, a set of specially designed chutes completes the separating operation by sending each blank to its respective destination via underfloor belt conveyors. All stator blanks are delivered to the 250-ton multislot presses; all rotor punchings to either a multislotting press or notching press, depending upon size.

MULTISLOTTING

At the multislot presses, blanks are raised from the underfloor level to feed hoppers via magnetic-belt conveyors. They are fed automatically into multislot dies, ejected from the dies by positive strippers by means of an air-operated ram onto magnetic-lift belt conveyors at the rear of the presses, and loaded into stacking hoppers. At a predetermined height stacked punchings are ejected from the stacking hoppers and sent down



Stator cores . . .
are automatically welded at 12 points (foreground) in this core welder. Correct number of punchings is obtained by weighing



Rotor and shaft assembly . . .
is dynamically balanced in a special machine right next to the rotor-turning lathe

gravity roller conveyors to the next work station. Stators go to the welding machine, rotors to the annealing furnace. Where rotor blanks are notched on index presses, a belt-lift conveyor raises them from the underfloor level and loads them into bins where they are loaded into the feeding hoppers by the operators.

Thus, automation is almost complete in the punch-press area. The only manual operations are: threading the coil stock at the beginning of a reel through the slide feeder into the double blanking die, and for some rotor sizes, loading the rotor-blank feed hoppers in the notching presses. Scrap is directly removed from machines to a scrap hoist by underfloor oscillating conveyors. The scrap hoist raises and loads the scrap into a bin outside of the building. By handling all punch-press material and scrap in this manner, areas around the machines are kept clear so die changes and maintenance can be effective and efficient.

WELDED CORE—A NEW METHOD

After stator punchings leave the last punch-press operation at predetermined stack heights, they are weighed as a positive check to ensure the required number of punchings for a stator core. They are then automatically loaded, three stacks at a time, on the loading arm of the welding machine. At each indexing of the machine, three stacks are loaded, welded by the inert- arc process and unloaded onto gravity roller conveyors leading to the annealing furnace. The welded stator-core construction is one of the major process changes that we have incorporated into our new manufacturing plan.

At the annealing furnace loading station, an operator loads stacks of rotor punchings and welded stator cores onto trays where they are automatically transferred through a preheat chamber, annealing oven and cooling station. The cycle takes approximately four hours. This annealing process was included in our manufacturing plan to avoid the use of mill-annealed silicon steel. Thus a longer life can be expected from our punch-press dies, and better electrical properties can be obtained from our stator cores and rotor punchings.

After annealing, stator cores are transferred by gravity conveyor to a grinding machine where the outside diameter is ground. Rotor punchings are transferred by gravity conveyor to a station where they are stacked, skewed, and tightened on an arbor prior to casting.

The stator-core grinder operates on an automatic cycle. After the welded core is plunge-ground to desired size, the grinding wheel retracts and is dressed automatically. The arbor holding the core contracts while a loading arm lifts and cradles the ground core, after which it lowers the core on a gravity conveyor. A ram actuated by an air cylinder pushes the core across a limit switch on the conveyor for transfer to the coil-insertion area. The limit switch releases an unground core onto the loading arm, which lifts and positions the core on the arbor of the grinding machine. After the loading arm lowers, the arbor expands to hold the core, and the grinding operation repeats itself.

ONE MANUAL OPERATION

After grinding, the stator core on its pallet passes the coil-winding machines. Coil-winding operators load wound coils on an arm attached to the pallet. The loaded pallet is transported by moving-belt conveyors past a series of operators who insert coils and insulating materials into the core slots, after which, at the end of the line, cables and leads are connected. This is a progressive line with each girl working on each stator for a predetermined number of minutes. The length of time required to insert and connect stators of the various poles determines conveyor speed. In this one section in the line a majority of the work is performed manually.

After insertion and connection, stators are subjected to a phase and hi-pot test in which approximately twice the amount of voltage required to run a motor is applied. Failures are found and repaired at this point in the line rather than after final test.

Upon passing preliminary test,

the stator is completely finished by successive dips and bakes in an insulation process. The stator insulating and baking oven is another point in the line where almost complete mechanization has been achieved. Stators are carried through six separate operations automatically. An operator loads wound stators on loading arms attached to a monorail after which they travel through the various preheat ovens, dipping operations and dry ovens, returning to the same operator for unloading and release to the subassembly entering the frame.

ONE REPLACES FIVE

Previously, frame castings were machined by a battery of milling drilling, boring and tapping machines requiring at least five operators. Because we wished to mass-produce frames, we decided to install an 8-station transfer-type frame machine controlled by one operator. Frame castings are fed by a gravity conveyor to the operator, who loads the frames in a fixture on a 3-station turntable. At the first station, the frame base is milled, while the conduit-box hole is drilled. At the second station, base and drain holes are drilled, and at the third station, base holes are reamed. Frames leave the turntable and are transferred past a series of in-line machining stations. At the first, one-half of the frame is rough bored, and end-shield bolt holes on one side are drilled. At the second, the same operations are done on the other side. At the third station, all end-shield bolt holes are tapped simultaneously. At the fourth station, the frame is finish-bored. After boring, the frame is cleared of dust and chips by going through a cleaning station. All operations are controlled from a panel between the turntable and the transfer section of the machine.

Machined frames feed by gravity conveyors to meet wound stators at an assembly machine. The frame is positioned in a fixture, and a stator is picked up by an arbor which presses the stator into the frame. An operator inserts the cable leads on the stator through the conduit-box opening in the frame prior to the press. The subassembly is then transferred to a drilling machine where dowel and nameplate holes are drilled in the frame. Dowel pins are inserted, and the frame is moved to a two-station machine which bores the inside diameter of the stator core and finish-turns the shield fits of the frame, maintaining very close concentricity with the bore. The boring cutter includes outlets for automatically exhausting the varnish, compound and punching turnings as the stator core section is moved against the cutter during the boring operation. This machine was selected because it does the work of four previous boring machines and two engine lathes, and it eliminates the labor of cleaning the cores after machining.

It is now necessary to go back and describe subsequent operations on the stack of rotor punchings from where we left them at the stack and skew operation.

WHY A HORIZONTAL DIE CASTER?

The rotor punchings are mechanically stacked and skewed, given a coating to improve electrical qualities and transferred through a preheat over to a special horizontal pressure die-casting machine for the casting of stronger, high-conductivity aluminum-rotor windings. A horizontal casting machine was selected over a vertical or centrifugal machine so that rotors could be moved in and out of the area efficiently to maintain a steady flow of completed castings to assembly. After die casting, rotors roll down a chute to a positioning device where loading hooks on an overhead monorail pick them up and transfer them to the rotor-and-shaft assembly area.

Hot-rolled, chemical-base, bar-stock steel cut to length and centered, comes to the shaft area. Motor shafts are turned on semi-automatic tracing lathes. One machine turns the pulley end, the other turns the opposite pulley end plus the rotor-body fit. Turning heads follow the templets first for a roughing cut, then return and repeat for the finish size. Both machines are loaded and unloaded manually by an operator, who during turning cuts keyways in the turned shaft on a keyseat-milling machine. Present tooling is exclusively carbide but oxides will be applied on all turning operations.

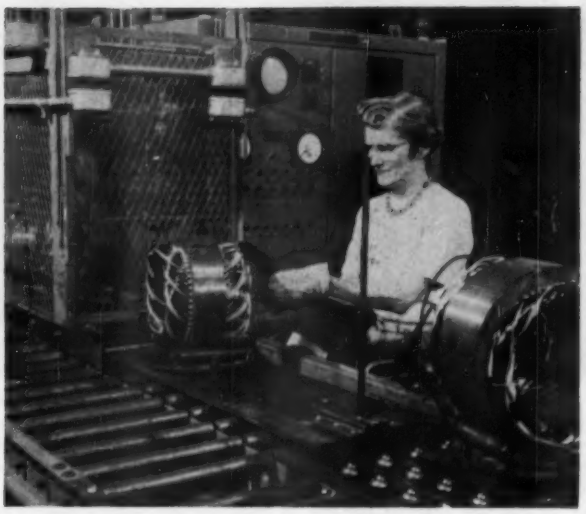
HOW TO AVOID A KEY

After being turned, the shaft is ground and pressed into the cast rotor. By broaching the rotor and setting up a minimum-maximum amount of pressure to be used in pressing the shaft into the rotor, the previous method of keying the rotor to the shaft has been eliminated.

The shaft-and-rotor assembly is then transferred to a semi-automatic turning lathe where the outside diameter of the rotor is turned to a close tolerance to provide the proper air gap between the rotor and the wound stator. The assembly is turned at high speed and one pass is taken with a special rotary turning tool. Upon completion of the turning operation the rotor and shaft assembly is automatically picked up and transported by an overhead chain conveyor to a dynamic balancing machine where it is balanced to NEMA requirements.

TWO REPLACE TEN

Raw end-shield castings are loaded with each frame size on gravity conveyors leading to a single take-off belt conveyor, with open and enclosed types kept separate. At the end of each gravity conveyor, there is a stop controlled by the operator at the machining station. The operator pushes buttons on a control panel, releasing the stops on the conveyors holding the type of end shields desired. Shields are released on a moving belt and transported to the machining operation area. Raw end-shield castings are fed automatically to rotary multi-station turning machines where rabbet fits are roughed and finished, bearing seats and shafts holes are bored, and faces on the shield are turned. Operations are performed in sequence simultaneously with the loading and unloading of the work, with double indexing providing two fin-



Wound stator cores . . .
are prepared by hand for preliminary test before dip-and-bake finishing

Finished motors . . .
packaged, go into a storage rack reminiscent of a supermarket. The operator on the platform applies a shipping label and unloads the motor, and a replacement slides down

ished pieces at each index of the carrier. Thus, we get two finished shields in the time of the longest operation plus a few seconds for indexing. This type of equipment was selected because one pair of these machines turns out as much work as ten automatic turret lathes where work is performed one station at a time. It was necessary to select machines designed and built to withstand strains of higher speeds, heavier feeds, continuous operation and also provide a definite level of quality.

Final assembly is completely mechanized. Motor components converge and move down a progressive line past assembly stations. At station one, bearings are pressed on the rotor and shaft assembly. At station two, the pulley end shield is installed and rotor and shaft are threaded into the stator assembly. The opposite pulley end shield is then installed to complete the assembly. Previously, motors were assembled on various conveyors holding the different components, so operators performed a great deal of lifting and positioning of parts in assembly operations. The progressive line brings all components to the operator where and when he needs them without unnecessary handling.

Final test is performed on an automatic test machine where resistance, impedance, hi-pot, surge and sonic tests are performed automatically as the motor is indexed to the various stations on a turntable. This type of equipment is able to handle the complete output of the lines efficiently.

Completed motors are transferred by belt conveyors to the paint booths, where they are loaded on a monorail and transported through painting into drying ovens. Finally, nameplates are attached, and the motor is packaged.

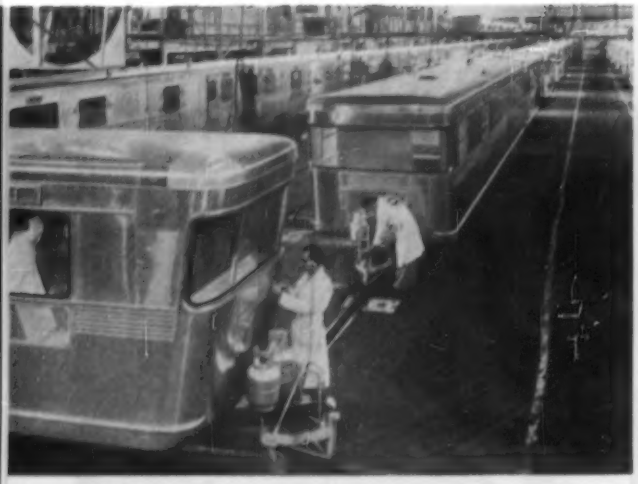
"SUPERMARKET" STOCKING

Compact warehousing was required in our shipping department for motors made to customer requisitions and motors used as stock. Each production line is provided with a storage rack that holds a week's supply of packaged motors. Motors are transported by conveyors to the rear of the storage rack and loaded into rows which have been set aside for the respective frame size, poles and type. Try to visualize how canned goods are dispersed in a supermarket, where if one can on the shelf is removed, another takes its place, and you will understand how we are able to ship motors in the order in which they were manufactured. Motors are gravity-fed to the front of the storage rack and unloaded by a movable carrier and placed directly on railroad cars and trucks.

Automation was not only a philosophy of manufacturing but "a way of life" in the building of our Tri-Clad* "55" motor factory. Highly automatic production units, best described as "pieces of automation," are integrated through a versatile conveyorized mechanical material-handling system into a smooth straight-line continuous process flow. Carefully planned storage points for component parts provide banks of material during setup and down times, so production cycles are maintained in an efficient, orderly manner. In addition to the above factors, flexibility in positioning of equipment and versatility of production lines themselves result in improved quality of our finished motor, a comparatively short manufacturing cycle, and a standard product line of over 100 models for our customers' selection. Concepts of automation predominated our planning of material processing and handling through receiving, manufacturing and shipping stages to give us capacity to meet not only today's market demands, but also increasing demands of the future. Service to our customers is being maintained at an all-time high.

** Registered trade mark of G E Company*

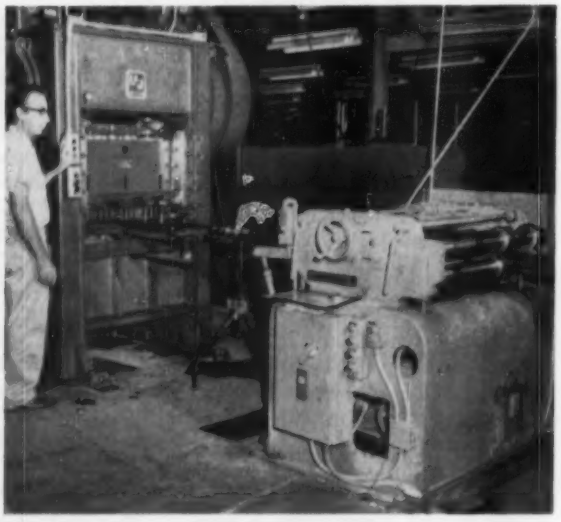
presses the stator into the frame. plus the rotor-body fit. Turning double indexing providing two fin-



Final assembly . . .
is supported by modern metal shearing, forming and assembly practices. Much ash wood is used in the interior of a mobile home, besides steel and aluminum. Spartan's conveyorized wood-scarfing and edge-gluing line removes defects from common lumber, reunites clear lumber in long lengths, making for great savings

An all-riveted . . .
assembly, this aluminum shell consists of two end panels, two side panels and a roof joined into a light, skin-stressed structure, as is common in aircraft construction. The shell rests on the main steel structural members of the perimeter-type underframe, so they function together to resist stresses. Cross-members of the underframe carry only the floor loads

Mobile homes made on a production line



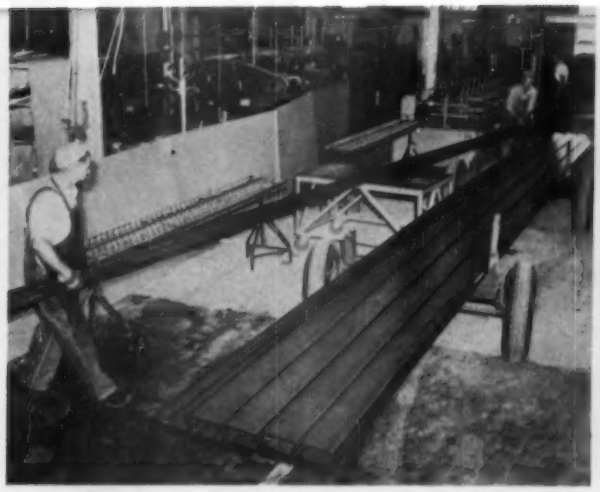
Strip stock . . .
for underframe members is uncoiled, roller leveled and cut off ahead of the roll-forming machine. Channels are made of 13-ga steel; cross-members of 10 and 14-gage

W H SHELTON, vice-president, SPARTAN AIRCRAFT CO, TULSA, OKLA

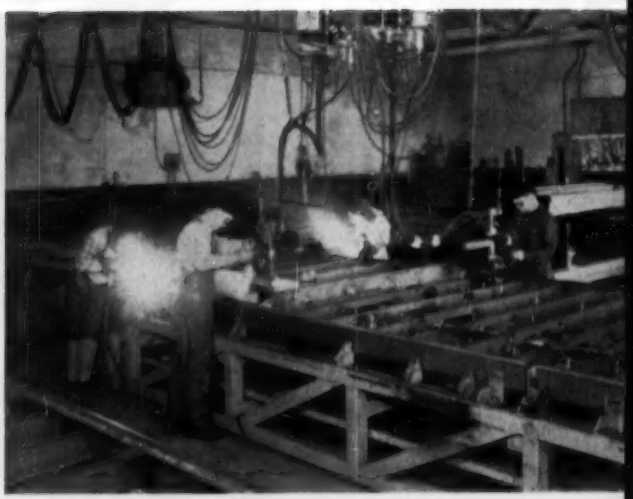
"Trailers" are essential to building a greater America. To provide well-paid migrant workers with suitable portable homes, a former aircraft manufacturer applies the skills of that industry and adds the production-minded ideas of the Middle West

The familiar bunkhouse is passing from the scene at construction sites. New industries and new communities are being built with less strain on the local facilities and less disruption of family life because of the "trailer," or more properly the "mobile home." On big jobs like the AEC installations in South Caralina, more than 10,000 mobile homes provided housing.

Most of these trailers were owned by the workers, who drove off with them to the next job. Soon, many

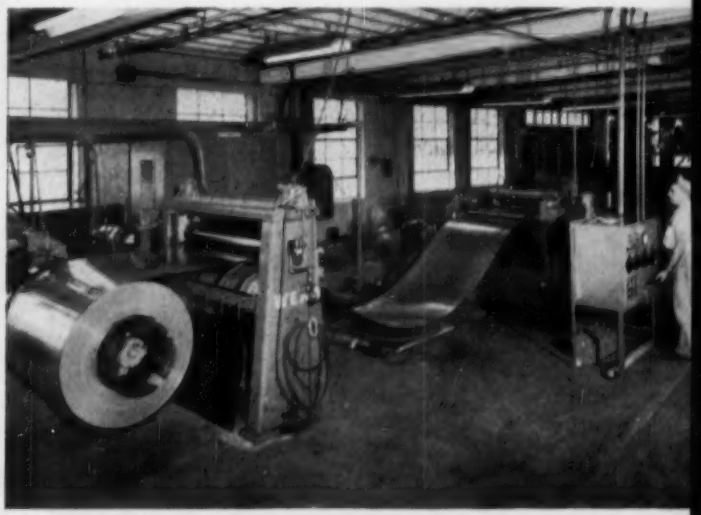


Roll forming . . .
on a Yoder mill is a fast and economical method of making frame members. The rolls are quickly changed for the different parts. Ball-bearing-type, run-out tables aid stock handlers to stack formed parts for delivery to the frame jigs



Frame members . . .
are held in exact alignment by means of specially designed jigs during the spot and arc welding processes. The frame is assembled upside down, to allow the aluminum subfloor and "A" frame to be installed, and the bottom half is welded. The partially completed assembly is then turned over and the balance of the welding is done. Exact location of the wheel and axle assembly is determined by positive locators on an assembly jig

An aluminum subfloor . . .
of 0.025 in. stock is applied to the frame, using air drills to drill the rivet holes



A Wean Shear . . .
leveling line for aluminum will return its $105,000 cost in less than a year through savings on extras for wrinkle-free and flat stock and the scrap loss in cutting to desired sizes. Equipment consists of a decoiler, pinch rolls, flying shear, and a 17-roll leveler

of these trailers may be seen at the St Lawrence Seaway project, because about 8000 workers would otherwise overwhelm the meager housing facilities in the area.

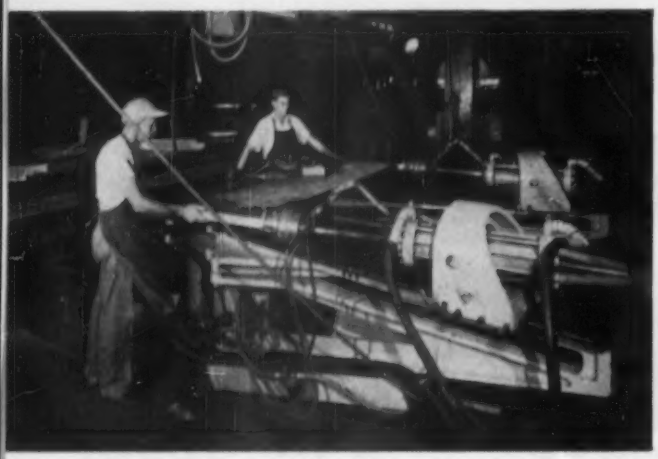
Mobile housing has become a way of life to a large number of people. It is estimated that 63% of existing trailers are used as homes by persons engaged in mobile or semi-mobile occupations, and another 20% by military personnel. The home that can be moved at little expense and with a minimum disruption of normal living patterns has therefore become an essential in the American economy.

The mobile home must be well built, attractive, and even luxurious to suit the tastes and pocketbooks of many highly paid workers. There are enough of these people (and their numbers are growing), to justify a highly developed manufacturing facility. At Spartan, we use over $2½-million worth of tooling, machinery and equipment, plus $2-million worth of buildings and other facilities for a single purpose—building an average of 20 mobile homes per day by production-line methods.

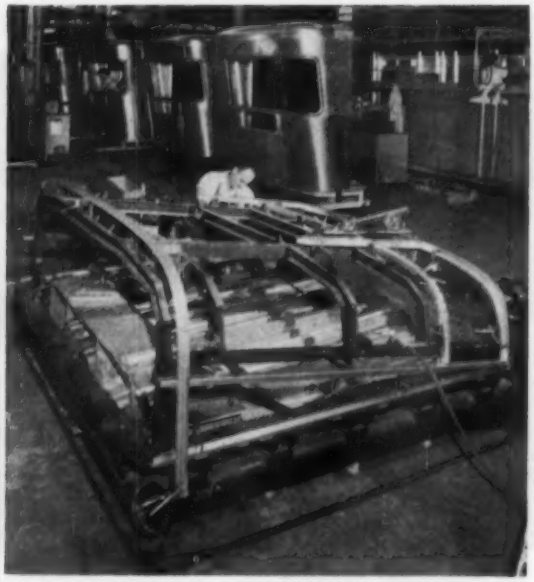
The product consists of an all-aluminum riveted shell resting on a steel underframe. As befits a home,

After leveling,
aluminum panels drop onto a conveyorized inspection table, thence onto plastic rolls in front of the operator, and slide off onto a stack. Leveler and cut-off unit run at a speed of 100 to 250 fpm, using dc motor control to obtain the desired operating rate. The roller-leveler line occupies a space of 20 x 50 ft. Galvanized strip for ductwork is likewise handled on this equipment

Mobile homes made on a production line . . .



Stiffeners
for curved panels, like the front and rear end sub-assemblies, are formed on a Hufford stretch press. Fits are assured because the entire structure is lofted, as in aircraft construction, and full-scale templets are made to show the profile, contour, and layout of holes and bend lines of each part and sub-assembly. Thus, any part can be checked against a master for interchangeability. The system is Spartan's means of assuring low-cost mass production

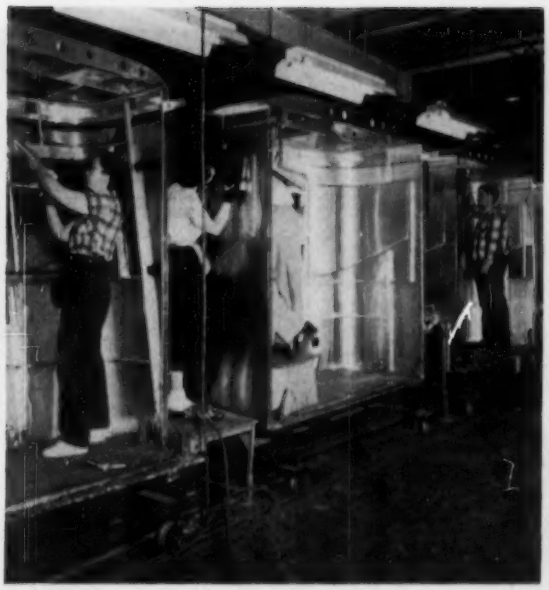


An aircraft-type fixture . . .
is used to assemble front ends and rear ends. Once the basic framing is assembled, it is placed upright on a wheeled jig for assembly of the skin panels. Only rivets are used in the stressed-skin construction. A trailer contains 8757 rivets—897 in the front end, 891 in the rear end, 2,269 in the left-side panel, 2,137 in the right-side panel, and 2,589 in the roof. Spartan makes these rivets

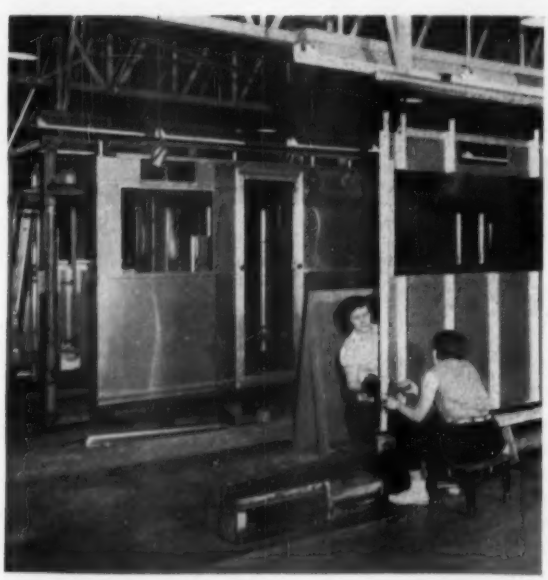
the trailer is fitted out with a variety of equipment —plus birch paneling, ash furniture, rugs, draperies; it is suitably insulated and even air conditioned, and it is adequately wired for lighting and power circuits. To supply the basic mobile home and the various equipment options required by customers, we must stock 3,804 different items.

Much thought and planning are necessary to design and build a mobile home that has the right "eye appeal" and quality. At Spartan, the engineering department is the architect. In this department are experienced stress analysts, electrical engineers, draftsmen, designers and aircraft engineers. These people are supported by tool and manufacturing engineers and by the manufacturing facilities mentioned. Today, the mobile home is a mass-produced quality product quite unlike the prewar wooden shack on wheels.

Skin panels . . .
with deep forms are produced in a Cecostamp fitted with Kirksite dies. To make these dies, Spartan operates its own pattern shop and foundry. First, a plaster form is made, next the form is packed in special foundry sand. After removal of the pattern, the foundry pours Kirksite, which is highly polished on the die surface

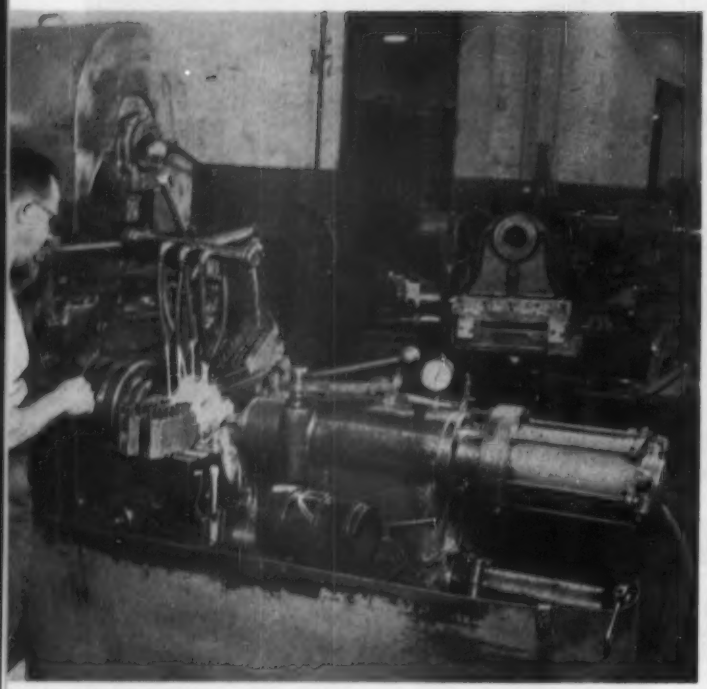


Front-end . . .
assembly jigs roll along floor tracks as in many straight-line-flow assembly systems. All jigs and fixtures are designed by and built under the supervision of the Jig & Fixture Department at the same time that the Tool & Die Department is developing suitable precision tooling

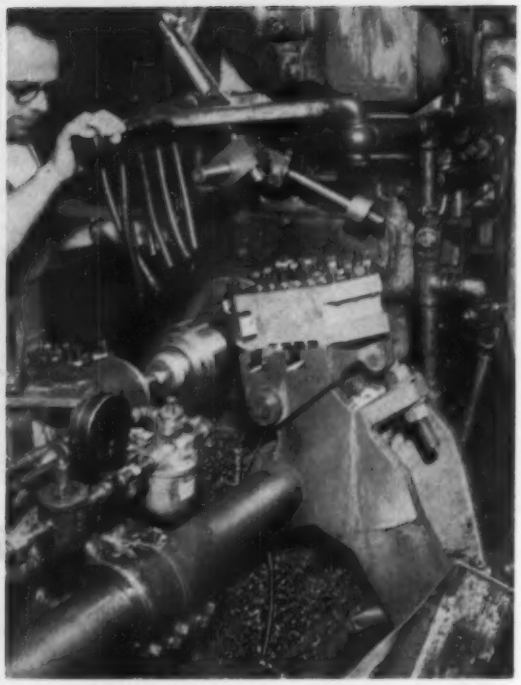


Side-panel assembly . . .
starts on aircraft-type jigs of welded tubular construction. After the main members and skins are in place, the partially completed sub-assembly is transferred to a conveyor line (foreground). At various stations, ribs and stringers are riveted

Roof panels . . .
are assembled on roll-over jigs, which are heavily braced to avoid distortion of the assembly. At final assembly, the roof is double insulated with layers of glass-fiber insulation with reflective foil vapor barrier between. An additional layer of insulation is secured to the underside of the roof skin by special adhesive



Tooled for rough turning . . .
6¾-in. OD, 3 5/16 in. long reverse-gear forgings, this 20 x 25-in. Fay automatic lathe has a Caterpillar-designed adjustable backarm and improved toolblocks to simplify setups



Adjustable backarm . . .
operates in the same manner as conventional backarms on Fay lathes, but has a tiltable platen on which toolblocks are bolted and keyed. Hinge bolt, supporting platen, fits in tapered sleeve (sketch) to eliminate play in setup

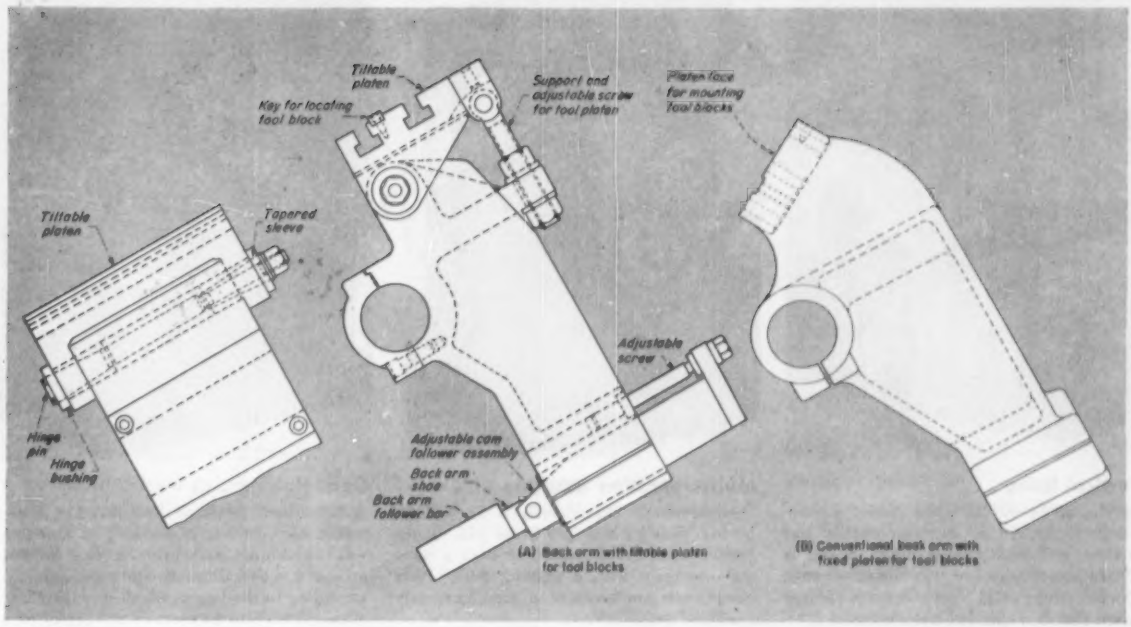
Adjustable backarms speed automatic lathe setup

ROBERT C GREER, supervisor of tool design, CATERPILLAR TRACTOR CO, PEORIA, ILL

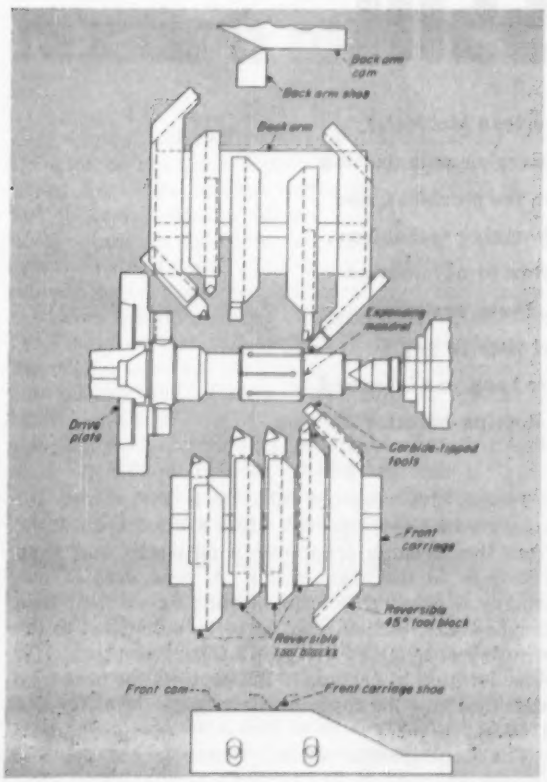
Tooling setups on a number of Fay automatic lathes in Caterpillar Tractor Co's Peoria plant have been simplified by installing backarms equipped with easily adjustable toolholder platens. Designed by Caterpillar tool engineers, these backarms make shimming toolblocks unnecessary to correct working height.

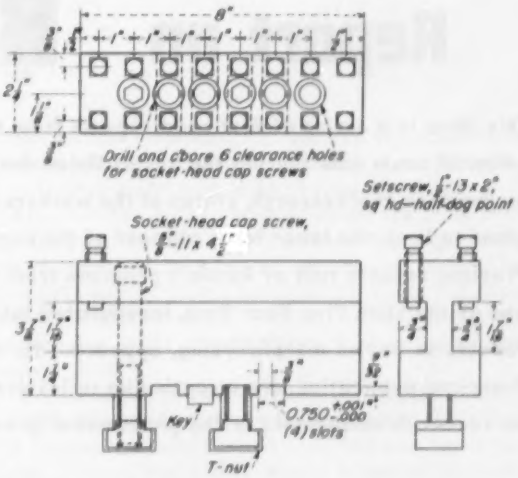
The new backarms have T-slots and keys for definite positioning of improved toolblocks developed concurrently. Front carriage supports have also been changed to take the same toolblocks. Three types have been designed in sizes to suit the various lathes for roughing and finishing forged gear blanks and other tractor parts. Two straight blocks are provided, for single and double setups, and there is a 45° angular block to permit bringing the cutting edge of a tool close to that of another where necessary. All blocks are reversible to simplify tooling arrangements.

Modernization has also included, in many cases, the installation of larger air cylinders to actuate tailstock spindles. This provides more power to operate the expanding, self-locking mandrels designed to permit taking heavier-than-usual cuts. A standard mandrel is used in the sketch to illustrate setup.


Tiltable platen
Key for locating tool block
Support and adjustable screw for tool platen
Platen face for mounting Tool blocks
Tiltable platen
Tapered sleeve
Adjustable screw
Hinge pin
Hinge bushing
Adjustable cam follower assembly
Back arm shoe
Back arm follower bar
(A) Back arm with tiltable platen for tool blocks
(B) Conventional back arm with fixed platen for tool blocks

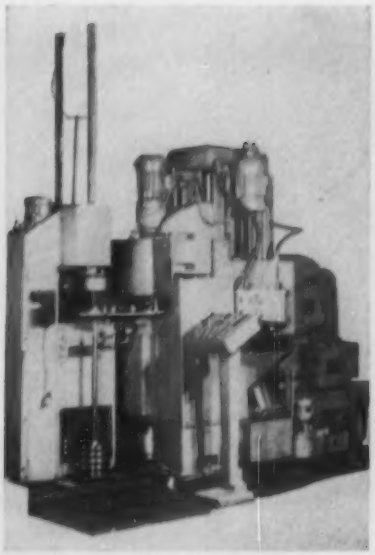
Tiltable-tool mounting platen . . .
is major difference between backarm *A* and conventional Fay backarm *B*. Both employ the same adjustable cam-follower assembly. Arm and tiltable platen are made from cast steel to insure adequate support to carbide-tipped tools taking heavy roughing cuts



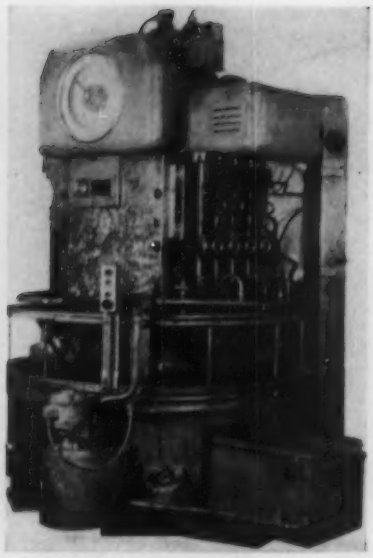


Keyways and clearance holes . . .
for hold-down bolts are spaced on 1-in. centers for easy positioning of block on supporting platen. This two-tool straight holder is comparable with other holders

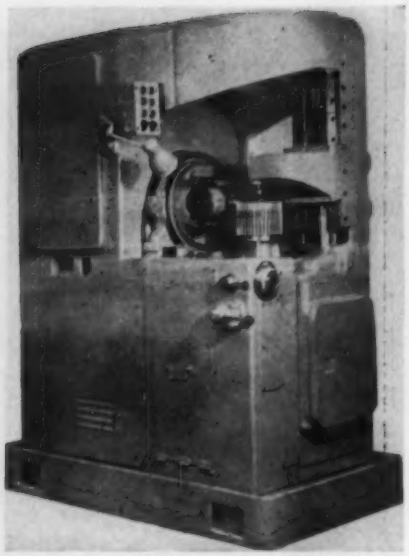
Toolblocks for new backarms . . .
and front carriages permit close, accurate spacing of front and rear turning and facing tools in a wide range of setups. Blocks are reversible on supporting platens and are located radially in relation with the work by keys and heavy socket-head capscrews



Vertical lathe . . .
Developed by ENIMS, the Soviet tool-research organization, machine carries out turning and facing operations. Work is lifted magnetically and transferred to work spindle, where it is mounted on a splined arbor that is expanded automatically



Multi-operation machine . . .
Semi-automatic unit developed by ENIMS for machining piston pin bores will rough-bore, cut oil groove, precision-bore a hole, and size-ream with a shaving pass. Four components are operated on simultaneously



Gear Hobber . . .
A "standard" machine intended for automated lines, hobber is designed so that the vertical column and overarm can be rearranged to suit alternative flow and loading according to the line in which it is installed

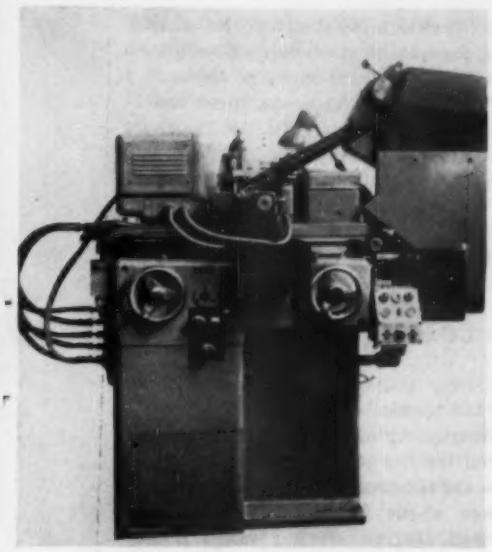
Report on RUSSIA PART 3...

This third in a series of first-hand reports from the *American Machinist* editorial team now touring the Soviet Union describes Russian organization for machine-tool research, status of the workers who run the machines, and plans to keep the labor force abreast of the rapidly advancing technology. Previous reports told of Russia's progress from revolution to automation and of the sixth Five Year Plan, inaugurated last year. These exclusive reports on Soviet metalworking, appearing for the first time in any American publication, are a continuing series designed to keep you informed on recent developments in the phenomenal growth of Russian industry.

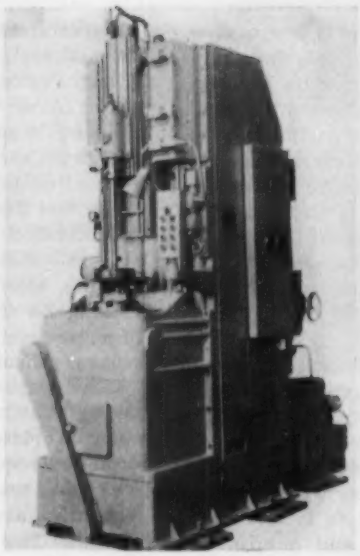
As indicated earlier, research organizations in the Soviet are on an enormous scale. The main machine-tool research organization, ENIMS, for instance, employs no less than 1000 scientific workers, plus 1000-or-so non-scientific workers in the adjoining and associated development works —and this organization is solely concerned with metalcutting machinery! There are other institutes, not so large, which deal with metalforming machinery, abrasives, and cutting tools. Approximately 2500 to 3000 people are employed in them.

Twenty-five-year-old ENIMS is the center for machine tool development. Ideas are fed both ways, from the research organization outwards and from plants in to the organization. A good deal of autonomy is granted to firms in building up their own design staffs; but all ideas must be submitted to the Ministry of Machine Tools at a fairly early stage for consideration by a council. All projects for universal machines must be approved both by the Ministry and ENIMS.

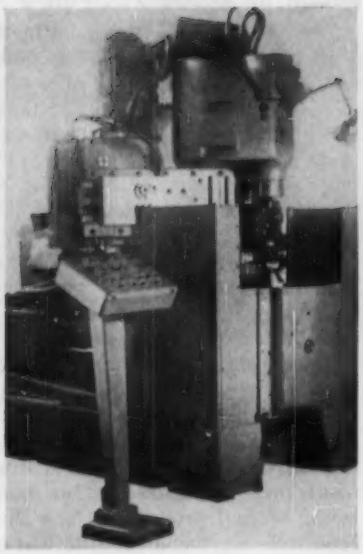
The experimental works, where prototypes and



Small center-type grinder . . .
Machine is provided with automatic loading for work on diesel pump pistons. Operating time is 4 sec per piece



Broaching machine . . .
Splines are broached on this machine, which is located in an automatic gear line. There is a 1½-mm step between broach teeth for coarse feed



Vertical lathe . . .
Semi-automatic multi-tool lathe is a recent ENIMS development. Prototype was built at the Stanko-Konstructia factory, which also made prototypes for most of the research-developed machine tools shown on these pages

research and training

development are carried out, is directly under the Director, as are the scientific board and engineering board. Two main sections under the Deputy Director are the responsibility of the assistant chief engineer, who is responsible for engineering research, and the chief designer. Sub-sections under Research include general research, electrical, hydraulic, automation, machining methods, metallurgy in relation to machine tools, and units and mechanisms. On the design side are sections for lathes, automatics, and milling and planing. The grinding section is again subdivided to include plain and universal grinding, surface grinding, polishing and honing, and so on. A section for gear cutting research includes sections for production of spur gears, bevel gears, a research laboratory and a modernization bureau.

STANDARD MACHINES FIT AUTOMATED LINES

The present trend toward automation of Soviet industry goes much further than the already plentiful supply of highly complex linear and rotary indexing machines. A whole range of so-called standard machines is being developed, which can be dropped, as it were, into an automated line at will. These machines are one of the important projects at the ENIMS metal-cutting research organization in Moscow; prototypes are being built at the Stanko-Konstructia plant, said to be in Leningrad.

All machines in the standard range are built with uniform table heights, so that they can be readily linked together to form an automated line. And they have special design features that cover handling through each machine's cycle, from picking up through the cycle of operations to ejection of the finished part.

This trend is obviously not only going to make it a great deal easier to build up automated lines, but will also offer flexibility and open the way for automated lines in operations where a special transfer machine would not previously have been justified.

Among machines of this type either in production or in development are a gear hobber with adjustable vertical column and overarm to suit flow and loading of line; a two-spindle copy miller; a vertical lathe with magnetic lifting of work and pneumatic loading; a centerless grinder with friction-type feed tube; a gear shaver; an automatic grinder with automatic loading and size checking; a spline-broaching machine; and a dynamic balancing machine with automatic correction by drilling.

PLEASE TURN PAGE ▶

Report on Russia . . . Part 3

The All-Union Cutting Tool Institute is a separate organization set up in 1944 to design tools and test for the tool industries and plants. It operates broadly on the same principle as ENIMS. There are three main branches. Of these, the design department has three sections, or laboratories, which carry out research into standard techniques, tools for automation, and gearcutting tools.

The second department is technological and deals with special problems relating to production of tools, including machinability by standard techniques, welding of tools, foundry tools, shaping, and application of carbide tips.

The third is a metallurgical department with mechanical, physical, chemical, heat treatment, high frequency heating, and metallography laboratories.

A special laboratory is engaged in machinability and cutting-tool tests. Other engineering departments include standardization, economy, and organization of tool production. The Institute is also responsible for technical information and published work, and gives technical help to factories. In addition, there are an experimental plant, a measuring laboratory, and another laboratory for the use of radio-active elements.

Briefly, the main terms of reference for the Cutting Tool Institute are as follows: design of tools, development of technical problems of production, investigation of cutting problems, testing of cutting tools, and standardization.

FACTORIES COMPETE FOR SKILLED LABOR

In a Moscow factory we visited, shift work was in force, but the management admitted needing far more workers than it could get. At present, the plant is advertising for labor, and there is plenty of competition for the worker.

Workers are divided into eight categories of skill and qualifications, the qualification being determined by test. Periodically all workers must go through a special course to bring them up to date, these courses being organized by trades. Initially, workers come from special schools or classes which they can enter after 10 years at other normal schools.

The first year at these is spent at the school and the second at the works. During these two years, basic information is provided on theory of metals, drawing, estimation and so forth, the syllabus depending on the work which the youth will take up subsequently. Large works have their own associated schools.

Some workers may still come through without having attended the special school. In this case the works provides instructors and basic theoretical information required for the job.

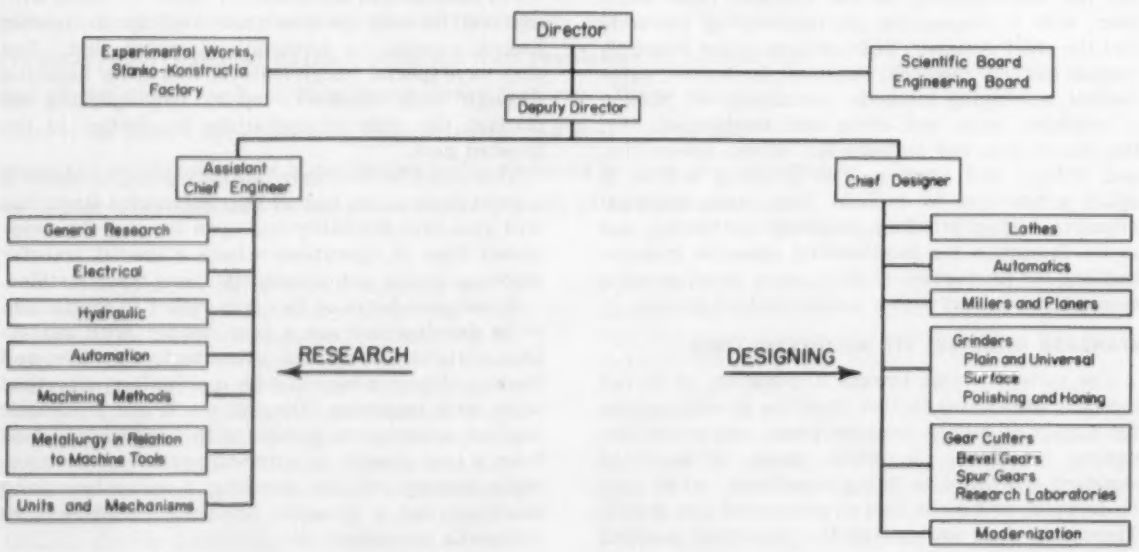
Typical wages are those of Fourth Degree workers, who average about 980 to 1000 rubles a month. The Sixth Degree worker takes home about 1200 to 1300 rubles.

Pay is on a piecework basis, but bonus incentives can also be employed. Engineers come from technical institutes and schools. Mainly, they work in the shops for two to three years. Workers with high qualifications can go to evening schools, technical colleges, or high schools. Of the 3500 workers at the Moscow plant we visited, 200 were engaged in further education of this kind. Ages of these students vary from 20 to 50.

One aspect of the competition for labor is that it is leading to construction of housing accommodation by factories seeking labor. Once built, housing is handed over to the local Soviet.

Engineers are represented by a Society of Engineers, which is divided into sections covering all

SOVIET MACHINE-TOOL RESEARCH ORGANIZATION (ENIMS)



branches of engineering, such as mechanical, production, electrical, and so on.

A study of directives and reports on the Sixth Five-Year Plan indicates that the Soviet is well aware of the need for higher labor productivity and better management. The improvements envisaged will affect certain aspects of wage earning.

Present practice is often to make output quotas correspond to a definite wage level, and not to technical and efficiency levels already achieved. The Plan demands that order should be brought into the system of wage rates in industry without delay so that technically substantiated output quotas can be introduced on a mass scale.

It is also admitted that there are wide discrepancies in the payment to workers in the same trade, and often even in the same locality. Considerable improvement is also called for in existing systems of payment for engineers, technicians, and economic executives.

It is planned that part of the remuneration received by this category should be strictly dependent on the basic performance indices of the enterprise concerned. Briefly, to quote the report; "We are faced with a very important and urgent task; to put in order the system of fixing rates and payments for factory workers and engineering personnel."

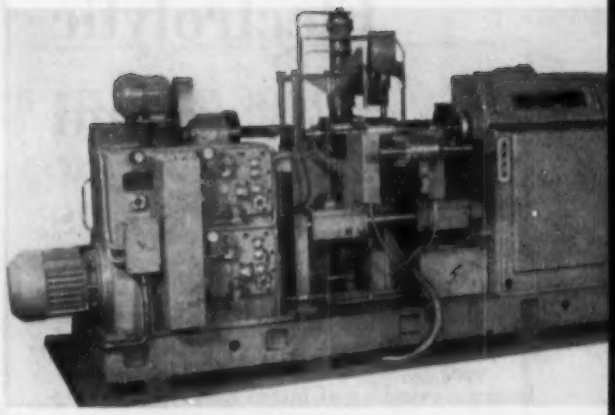
Other plans that will affect labor during the next five years include (1) raising the wages of the lower income categories of workers, (2) going over beginning in 1957 to a seven-hr. working day and (3) reducing the working day on Saturday. Working day for workers between 16 and 18 is to be re-established at six hours.

Further development of education is looked upon as one of the key problems. In addition to secondary schools, both general and specialized, there will be further expansion of correspondence and evening courses. During the current plan, 6.3-million students will complete secondary schooling.

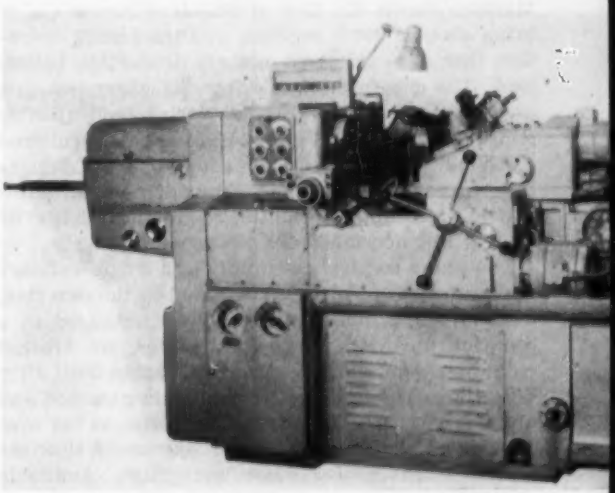
Development of polytechnical training in the general school has not been adequate so far, and the plan calls for improvement. There are also extensive plans to increase training of specialists. At present the Soviet employs 5.5-million in this category. In the current period, it is planned that no less than 4-million specialists will be trained in the higher and specialized secondary schools. This is nearly as much as in the two previous five-year periods combined.

It is interesting to note the breadth of education the Soviet is calling for in its specialists. This is clearly indicated in Bulganin's report; "Economic and cultural development requires a marked improvement in the training of specialists; they must be conversant with the latest achievements of Soviet and foreign research and engineering. What is needed is a much more intimate combination of theoretical and practical knowledge of production."

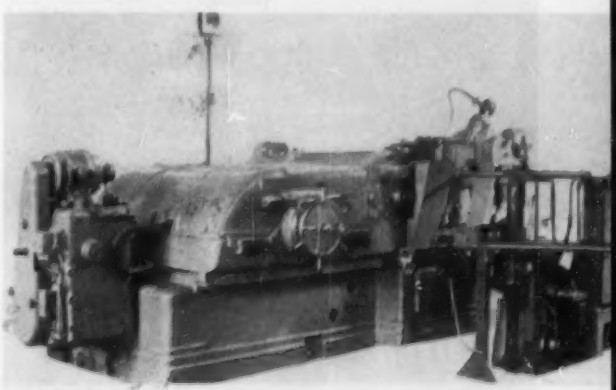
Part 4 of Report on Russia will appear in the Jan 14 issue of American Machinist. This series will be interrupted in the Dec 31 issue for a special summary of Russian work with high-speed machining.



Dynamic balancing machine . . .
Made to balance ac squirrel-cage rotors, balancer incorporates automatic drilling for correcting balance. It was specially designed by ENIMS for installation in automated lines, such as those reportedly at Tallin, Tomsk, and Kharkov



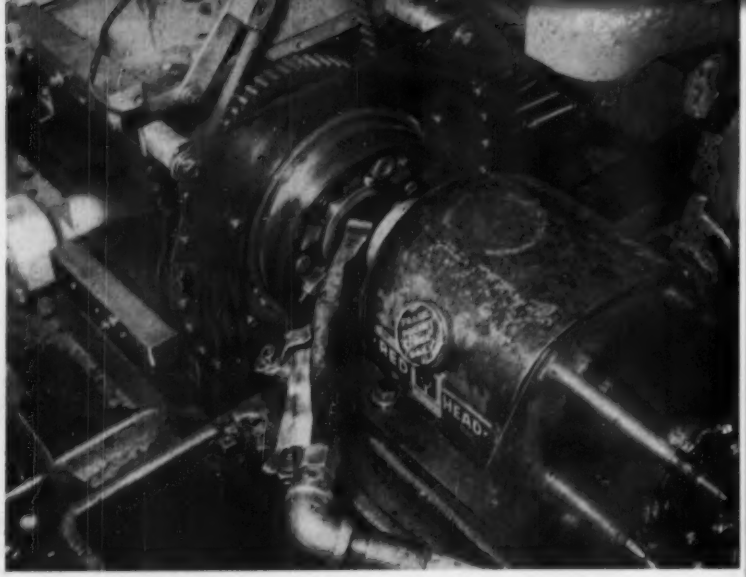
Automatic turret lathe . . .
Automatic chucking and programme control at tail end of bed are features of this lathe. Programming is electromagnetic, and speeds and feeds are set by dial



Grinding machine . . .
Four pistons are ground simultaneously in a 32-sec cycle on this unit, which is equipped for a piston line operating on a 4-in.-dia truck piston. When used for bearings, machine is equipped for through feed

Electrolytic grind triples cam output

Internal grinding of pump cam rings in HSS is speeded by converting Heald Size-Matic to electrolytic cutting with diamond wheel

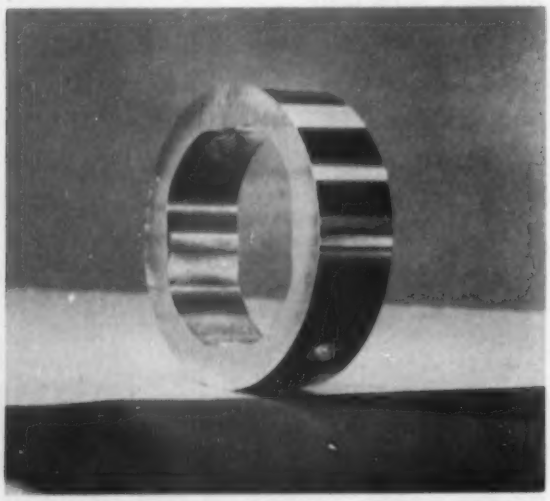


CAM-GRINDING OPERATION . . .
is shown in close-up view. Brush assembly to carry electric power to the diamond wheel appears at lower right. Coolant, which serves as electrolyte, is fed at rate of 2 to 3 gpm

Electrolytic grinding is being used by the Hartford Machine Screw Co, Div of Standard Screw Co, to bring about a 300% increase in a machining operation that once created a serious production bottleneck. The grinding of a plunger-actuating cam ring used in the company's Roosa-Master fuel-injection pump for small diesel engines proved a difficult and costly operation, prior to the adoption of an electrolytic process powered and controlled by an automatic, electronically controlled rectifier built by Anocut Engineering Co of Chicago.

The pump consists essentially of a single-cylinder unit with opposed plungers actuated by the cam ring, inlet metering, and distributor—all packaged in a compact unit for flange, distributor, or bracket mounting. Actual production didn't begin until after World War II, although the pump was patented and made in very small quantities just prior to the war.

Grinding of the cam ring was extremely slow initially, and abrasive costs were high. Available grinding methods produced only about 50 cams a day per machine. With the electrolytic method (*AM* —Nov 10 '52, p154) production is up to 150 cams a day per machine.



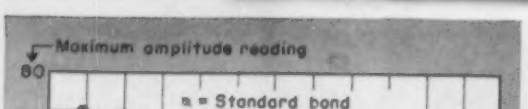
FINISH-GROUND CAM RING . . .
will be used in a fuel-injection pump to actuate a plunger. Contour form on ID is said to have finish accurate to within 6 to 8 mu-in. rms of specified tolerance

Made of hardened M-2 high-speed steel, the cam rings have an OD of 2.750 in., an ID of 1.886 in. Rings are received rough-cut, then are rough-mill formed on a Cincinnati profile milling machine with one cut. After hardening, they are sent for electrolytic grinding, where the ID cam form is finished to exacting specifications and tolerances.

A Heald Size-Matic internal grinder, modified for internal cam grinding, is used for the operation, together with the Anocut rectifier and a mechanism which provides the precise cam motion to generate the desired contour. Diamond wheel used in the process is ¾-in. dia, has 1-in. face width, and runs at approximately 5000 sfpm. A plunge cut feeds wheel into work bore, with the wheel continuously advanced by power feed; work reciprocates along wheel axis, but with very short stroke. A special nozzle feeds the coolant electrolyte to the wheel at a rate of 2 to 3 gpm.

Because electrolysis does 90% of the cutting, wheel life has been greatly extended. Where previously it was necessary to make frequent wheel changes and to re-dress often, now hundreds of pieces are made with no wheel attention, and thousands can be made without wheel change. Automatic gaging of work is not necessary, for wheel wear is so small that no compensation is needed during the cycle.

Special test runs with the electrolytic grinding setup occasionally reached rates that were ten times greater than the original 50 a day. Although line production is not so high, the potential of the system approaches this figure, and ring production is expected to near this potential as the process is improved.



Two ways to "see inside" a sealed complex structure

Honeycomb sandwich, either adhesive-bonded or brazed, is a complicated assembly, all parts of which must be checked non-destructively for bond. Tapping the skin with a coin, much as a carpenter taps a wall to locate the joist, will spot large non-bonded areas. But close inspection must do far better than that—it must find small unbonded areas, then show why they aren't bonded.

Because honeycomb sandwich is one of the few structures with a margin of strength for tomorrow's higher requirements, and because "seeing inside" becomes increasingly important in all kinds of metalworking structures, we present here the two production methods of non-destructive testing. They are preceded by an explanation and comparative evaluation. All portions of this series come from Convair-Fort Worth, where the two methods were developed.

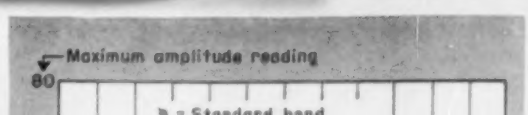
Ultrasonic vs radiographic inspection of bonded and brazed assemblies ...an evaluation

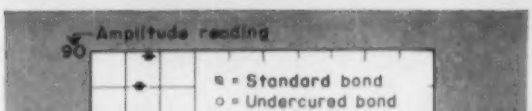
The STUB meter is a low-frequency mechanical-impedance device coupled to the bonded area of the test piece by means of a crystal or transducer. The bonded area then becomes part of a resonant circuit or system. When the transducer is varied over a range of frequencies, the response is picked up, amplified, and shown on an oscilloscope. The peak of the wave form corresponds to the resonant frequency of the bond line, and the height indicates the nature of the bond. Good bonds show low resonant peaks, resulting from maximum attenuation or damping. On the other hand, poor bonds result in higher peaks because the lack of bond allows the area under the transducer to resonate more freely and with little or no attenuation.

Thus the STUB meter is effective for inspection of adhesive-bonded structure because of the characteristics of the adhesive with respect to its ability to attenuate a signal. On the other hand, material used to braze a stainless-steel assembly, being metallic, does not have the same characteristics, thus is incapable of attenuating the signal in an adequate manner. Consequently, the STUB meter is not effective for inspection of brazed assemblies.

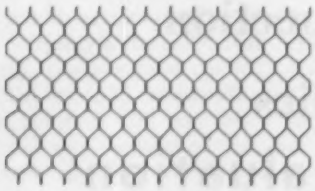
Effectiveness of radiographic inspection is dependent on density of the material through which the radiation must pass. On brazed assemblies, densities of the matrix components are relatively high with respect to those in an adhesive-bonded assembly. Further, the density of the brazing alloy is also high in comparison to that of an organic adhesive. As a result, minor variation in thickness or shape of either the brazing alloy or other components in a brazed assembly will be indicated as a wide range of film densities or a major variation in the gray scale reproduced by the film. Thus radiography is effective for inspection of brazed assemblies for determination of fillet sizes, lack of flow, excessive flow, excessive thickness of brazing alloy, cell misalignment, core damage, fit of detailed parts, etc. Radiography, on the other hand, is not effective as a primary means of inspection of adhesive-bonded assemblies because the variation in densities of the components does not result in a major variation in film density. However, radiography can be used on a limited basis to indicate cell misalignment, core crushing and fit of core to edge members.

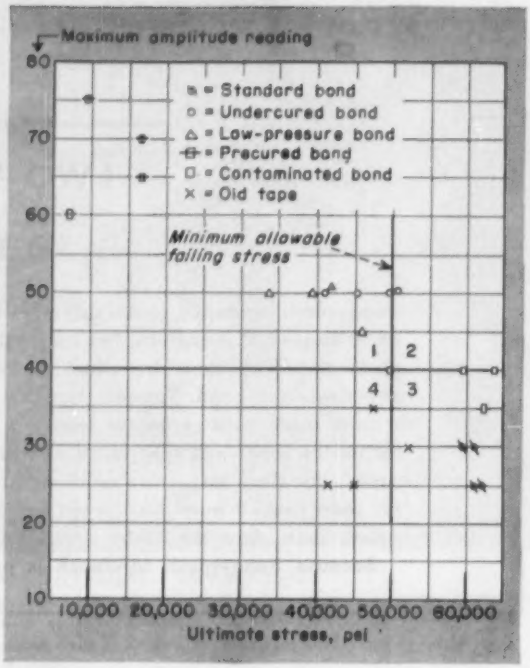
—EARL R WEIHER
chief of process control,
CONVAIR-FORT WORTH
A Division of General Dynamics Corporation





Type II ultrasonic bonding tester . . .
developed by Convair engineers, with which test work reported here was done





Non-destructive and destructive . . .
(simple beam bending at 260 F) tests gave these results on honeycomb panels of 0.040-gage, 2024-T-86, clad-aluminum skins over 3/16-in.-cell, 9-lb, Fiberglas core, with 422J adhesive. Built-in defects were: (1) voids caused by leaving out adhesive in that area, (2) undercured bonds, (3) low-pressure bonds, (4) contaminated bonds caused by improper cleaning of parts, and (5) precured bonds caused by heating the adhesive for 15 min. at 350 F before bonding

Adhesive-bonded joints

Mechanical-impedance methods of testing, originated by Stanford Research Institute, have been developed by Convair to inspect both metal-to-metal and sandwich bonded panels. Voids, and in some cases sub-standard bonds, can be detected. Tests can be correlated with destructive tests. Here the instrument, method, and problems still to be met are described

E L GRAY

senior chemist, CONVAIR-FORT WORTH
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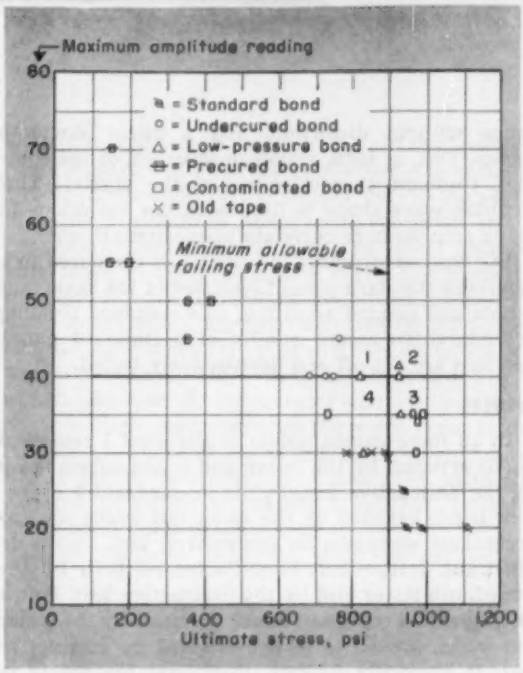
Structural adhesives are becoming increasingly common in aircraft. Convair-Fort Worth is presently engaged in development of two types of bonded systems for future planes: (1) honeycomb sandwich panels bonded with 422J[1] adhesive, (2) metal-to-metal joints bonded with Metlbond 4021[2] or Plastilock 620[3] adhesives. The need was for a method of determining whether a bonded joint is good or bad without damaging the part.

In June, 1954, Convair engineers visited two installations which had Air Force contracts to develop non-destructive methods of bond inspection: General Electric Company, Schenectady, NY, and Stanford Research Institute, Stanford, Calif. A mechanical-impedance method originated by James S Arnold of Stanford Research Institute seemed to show promise. The first Stanford mechanical-impedance instrument (called a STUB meter) consisted of a number of basic laboratory electronic instruments coupled together. This setup is very complicated, so Convair engineers developed simplified instruments which can be used in the shop to inspect bonded joints.

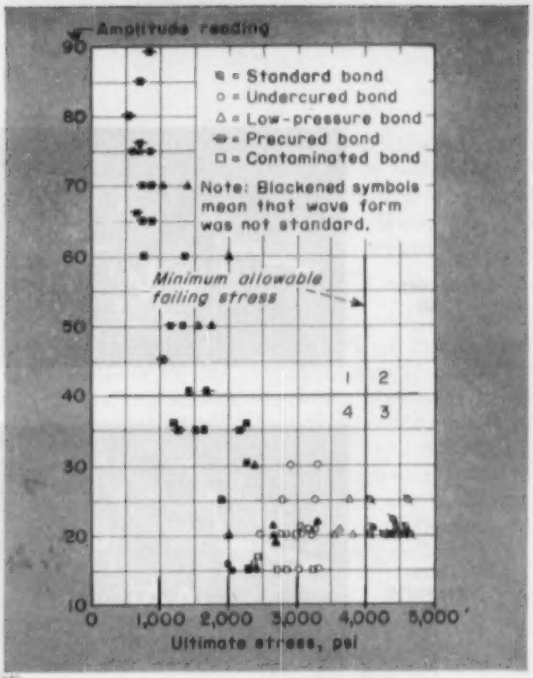
The mechanical-impedance technique utilizes as a basis of test the change in frequency response of an oscillating electro-mechanical system. This vibrating system consists of a piezoelectric barium-titanate ceramic disk coupled to the bonded panel with an oil film. A high-frequency oscillator and amplifier drive this crystal, and a sweep-frequency generator produces periodic amplitude variations in the voltage appearing across the crystal. Change in frequency response is detected as a voltage and fed into an oscilloscope. A sharp change in amplitude is noted as the frequency sweeps through the natural resonant frequency of the crystal. The natural resonant frequency for crystals 0.25 in. thick and 1 in.

[1] *Shell Development Company, Emeryville, Calif*
[2] *Narmco, Inc, Costa Mesa, Calif*
[3] *Goodrich Tire and Rubber Company, Akron, O*



Non-destructive and destructive . . .

(flatwise tensile) tests gave these results on honeycomb test panels. Maximum amplitude reading is plotted against ultimate failing stress in both this and the preceding chart. Horizontal line at 40 represents arbitrarily chosen maximum allowable amplitude reading. This with the vertical line showing maximum failing stress, creates four quadrants. In quadrants 1 and 3, the two test methods agree; in quadrants 2 and 4, they do not



Non-destructive and destructive . . .

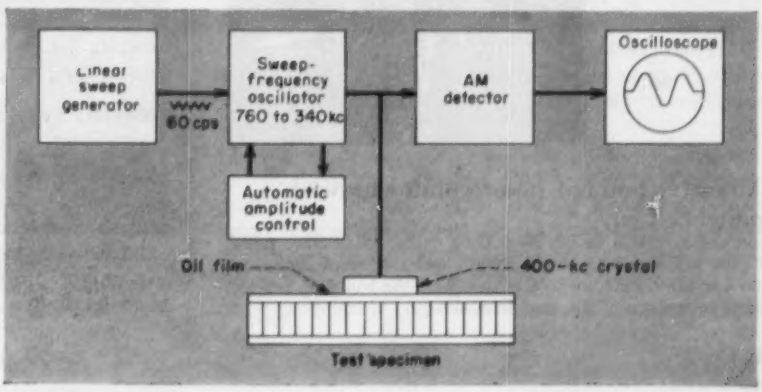
(lap-shear) tests of adhesive-bonded metal-to-metal joints containing special defects. Test panels were of 0.032-gage, 2024-T86, clad-aluminum plates bonded with Metlbond 4021 adhesive. Built-in defects include: (1) undercured bonds, (2) low-pressure bonds, (3) precured bonds, (4) contaminated bonds, and (5) standard bonds. The chart is prepared as were those for honeycomb, with maximum allowable amplitude set at 40 and maximum allowable failing stress at 4000 psi

tested by ultrasonics

in diameter is approximately 400 kc per second. A 60-cycle-per-second sweep of about ±100 kc per second has been used to best advantage.

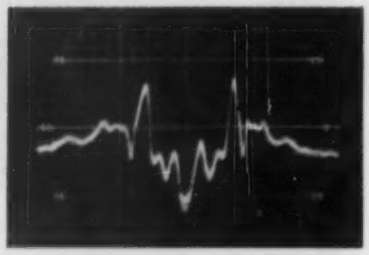
In brief, when the oscillatory transducer is coupled to a bonded panel with an oil film, the panel is forced to vibrate at the exciting frequency. Amplitude of this vibration will be a function of the damping of the panel. Nature of the adhesive bond will affect this damping; that is, the amplitude of vibration is dependent on mechanical impedance of the panel. This vibration, in turn, mechanically excites the crystal and produces a change in amplitude of the voltage across the crystal. This voltage is picked up and displayed on an oscilloscope. Wave amplitude and wave form give an indication of the bond.

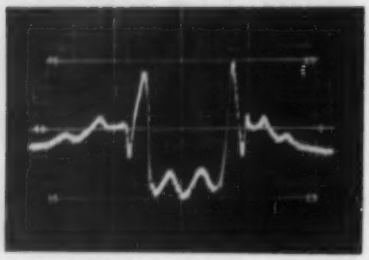
The first instrument developed by Convair (Type I) had a sinewave sweep over a very narrow range and showed amplitude modulation. This instrument gave a very simple wave form which was easy to read, because only the peak-to-peak amplitude was observed. It was later found that too little information is gained through the observation of voltage amplitude alone. A second instrument (Type II) was developed which was essentially free from inherent amplitude modulation. The latter design permits higher sweep voltages, wider sweep frequency

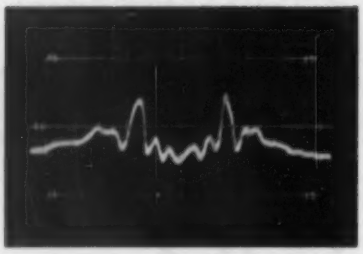


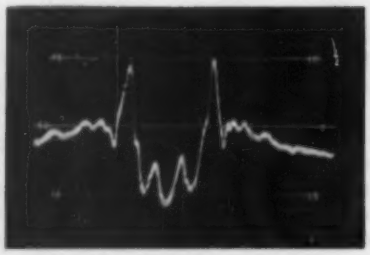
Block diagram of the impedance tester . . .

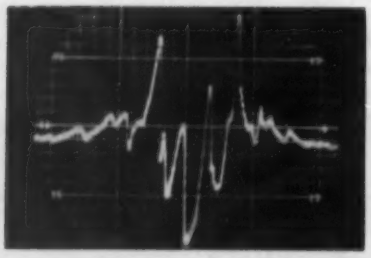
in tests here reported, amplitude reading from the standard panel was arbitrarily set at 25 units on the oscilloscope. Then readings less than 35 from specimens were considered acceptable, 35 to 40 questionable, above 40 substandard, and about 90 a total void. Any large deviation from the standard panel was considered to indicate a poor bond











Adhesive-bonded honeycomb sandwich panels . . .
containing various defects show these characteristic wave forms. Forms will vary with panels bonded under different conditions, so it is not always possible to determine the cause of a defect from observation of the wave form alone

range without distortion, and a linear sawtooth sweep. This, in turn, allows observation of the complex resonant characteristics of the crystal. This complex wave shape is used with the variations in wave amplitude to correlate bond-strength data.

The bonded structure in question is compared to a reference standard panel fabricated of the same materials and bonded according to a standard bonding procedure. To assure quality of a standard panel, portions are cut off and destructively tested.

RESULTS

In all three charts, points in quadrant 1 represent bonds rejected by the tester and found substandard by the destructive test. Points in quadrant 2 represent bonds rejected by the tester but which showed acceptable strengths in destructive test. Points in quadrant 3 represent bonds accepted both by the impedance tester and by the destructive test. Points in quadrant 4 represent bonds accepted by the tester but which proved to be substandard by destructive test. It obviously follows, then, that for points in quadrants 1 and 3 the non-destructive method is in agreement with destructive results, and that for points in quadrants 2 and 4 the two methods are in disagreement.

In the chart on adhesive-bonded metal-to-metal joints, blackened symbols represent bonds rejected because of non-standard wave form. If one considers amplitude of the wave alone, then, as before, points in quadrants 1 and 3 represent points of agreement, and points in quadrants 2 and 4 represent points of disagreement. However, in this evaluation an effort was made to distinguish between good bonds and sub-standard bonds on the basis of wave form. If both wave amplitude and wave form are considered, the blackened symbols in quadrant 4 as well as the points in quadrants 1 and 3 all represent agreement between the non-destructive and destructive methods. The unblackened symbols in quadrants 2 and 4 are still in disagreement. It is interesting to note that bonds rejected by wave form are in general located toward the low-strength side of the chart.

Review of these figures shows some defects are more difficult to distinguish than others. For instance, the "old-tape bonds" gave trouble on honeycomb-type structure, and the "undercured bonds" gave the most trouble on metal-to-metal joints.

These faulty bonds were purposely fabricated of intermediate quality to test the effectiveness of the instrument. It should be pointed out that in addition to giving an indication of the quality of these intermediate bonds, the tester is virtually 100% effective in detecting voids.

PROBLEMS STILL EXIST

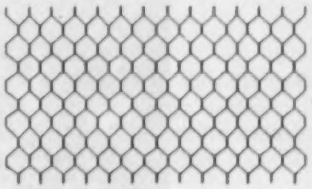
Development of the mechanical-impedance method of bond inspection represents a considerable advancement in non-destructive testing. However, because this method is very new, many problems still exist. Development work is continuing.

A major problem connected with this method of bond inspection is interpretation of the complicated

wave forms obtained. Any variation in the bond will cause a change in wave form, whether this variation affects the strength of the joint or not. In the photos of wave forms from honeycomb sandwich panels containing special defects, one can easily pick out differences in wave form and wave amplitude for the various panels. It should be pointed out that the wave forms shown are from a particular set of panels; for some other set of panels bonded under different conditions, other wave forms would be obtained. No one should assume that it is always possible from observation of the wave form to determine the cause of the defect. The present objective is not to determine the cause of a particular variation in a bond, but rather to separate defective bonds from good bonds.

Other problems connected with the mechanical-impedance method include: (1) variations (within tolerance) in the bonding process or materials, (2) setting of allowable limits, (3) testing of curved surfaces, (4) testing of rough surfaces, and (5) variations encountered on different ceramic crystals.

ACKNOWLEDGMENT . . . I wish particularly to express my indebtedness to J S Arnold of Stanford Research Institute for his invaluable help in getting us started. Grateful acknowledgment is also made to my many coworkers: R M Cunningham, who collaborated in developing this method; C E Horn and J S Stribling, for their work on instrument development; and J M Warren and J A Arnold for preparing test specimens. Thanks are also due N H Simpson, K E Dorcas, and S V Castner for their many helpful suggestions.

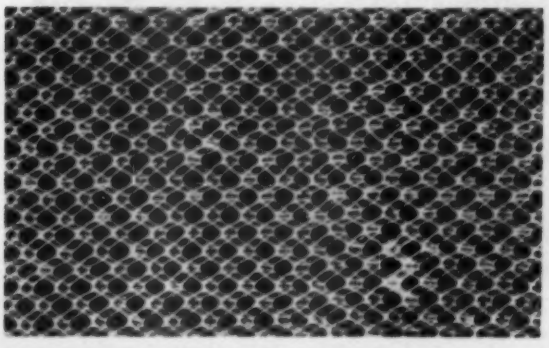


Radiography tests brazed stainless sandwich

S MASZY, process-control metallurgist,
CONVAIR-FORT WORTH, A Division of General Dynamics Corporation

Faster-than-sound aircraft and missiles have stimulated development of a new type of construction of internal structural and surface components. This consists of a honeycomb core sandwiched between two thin sheets, brazed in place, and having relatively high strength-to-weight ratio.

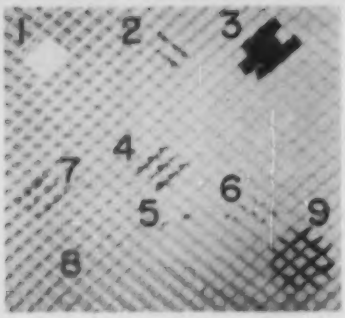
At Convair-Fort Worth, components of this type are being fabricated, on a production basis, from 17-7 PH stainless steel, which is heat treatable to 180,000 psi. Details consist of a honeycomb core with ribbon thicknesses as low as 0.001 in. The core is inclosed in an assembly by brazing thin sheets of stainless steel and heavier edge sections around the perimeter to form a totally inclosed component which may be attached to various structural members of the airframe. (Panels constructed from standard 300 series stainless steels do not present the brazing problems (because they do not contain the refractory-forming element aluminum), nor do they produce the high strengths desired.)



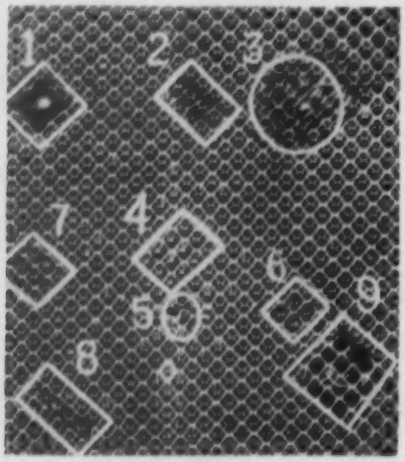
Radiograph of a good brazed panel . . . shows uniformity of fillets on top and bottom sides. Note that photo is taken from an angle to show joints on both sides

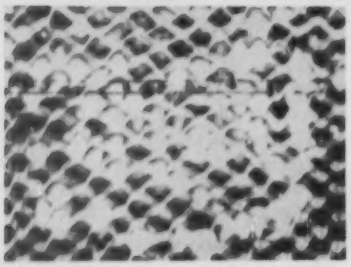
Components of honeycomb construction include internal structural members such as spars and ribs used to support the skin surface, skin surface panels and complete wing subassemblies. Structural members are usually thin flat components to which the skin assemblies are attached. The skin of the aircraft is fabricated from honeycomb components that vary from flat to compound-contoured sections. The trailing edge of the wing utilizes a section of honeycomb material that tapers from several inches in thickness to a feather edge.

Success in producing panels, while solving one problem, created another: that of non-destructively testing production components for quality of braze and construction. One of the early methods of inspection was with an impedance tester. This tester, also known as a STUB meter (see preceding article), was very unreliable on brazed panels. After several

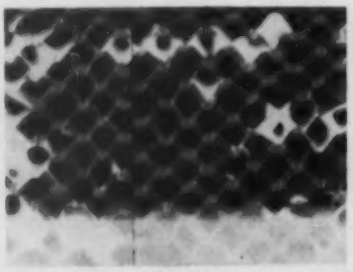


Here the core (top) has been damaged . . .
purposely to show how various defects radiograph (below): 1—missing cells, 2—torn cell walls, 3—void from contaminated core, 4 & 7—bent core, 5—core-node separation, 6—holes in cell walls, 8 & 9—crushed core





Excess brazing alloy . . .
which has wetted core and skin shows as light areas in a radiograph. Note, however, that there are no fillets at the core and skin junction. This is cause for rejection. There is evidence of alloy in most of the cells, indicating that it melted but did not wet the core. This suggests oxidation of the brazing alloy



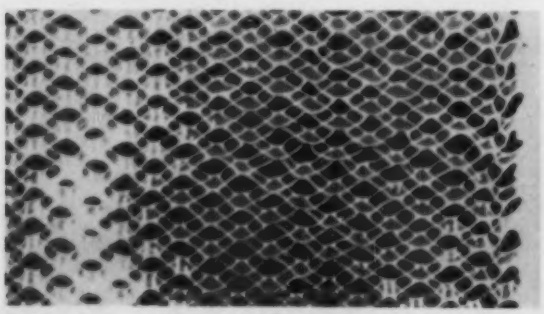
Here the brazing alloy melted and flowed . . .
but didn't wet either skin or honeycomb. Density of the core ribbon is uniform from top to bottom in the radiograph, showing absence of brazing alloy

other methods of testing had been tried and proved unreliable, a unique technique of radiographic inspection was developed by the Process Control Dept by which all-brazed honeycomb construction may be 100% inspected.

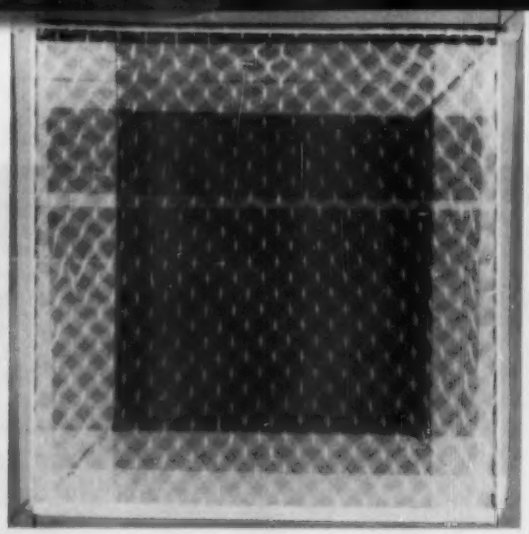
After a panel has been brazed, it is necessary to see clearly the fillets formed at the junction of the core and the skins of the panel. The detail of fillet formation of both surfaces can be obtained only if the angle of radiation and focal distance are sufficient to project the upper fillet of a cell past the lower fillet of that cell but not to or beyond the lower fillet of the next cell. Super-imposition of one fillet onto or beyond the next is the greatest problem we have encountered in radiography. This has been overcome by radiographing components perpendicular to the ribbon direction and at extended focal distances. Focal distances and angles of radiation are determined by cell size and over-all thickness of the panel. Current, potential and time will vary according to actual thickness of the material to be penetrated, and focal distance. The maximum sufficiently defined area per radiograph will, of course, be controlled by focal distance, current, potential, and time. After the radiographic technique has been established, the radiographer then has only to X-ray the panel and process the film.

PROBLEM OF INTERPRETATION

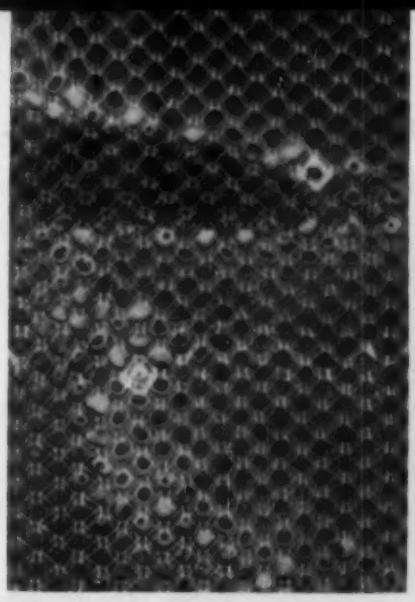
Although radiographic technique is essential, proper interpretation of the radiograph is even more critical. The pattern of the honeycomb on the radiograph is an optical illusion and must be overcome by the interpreter properly before he can evaluate the radiograph. To do this, the interpreter must be familiar with the established techniques of radiography for each type of component. Honeycomb evaluation is new in that the types of defects observed are not normally encountered in radiographic interpretation. Defects must be considered as to type, location, and concentration. Isolated irregularities in themselves are not necessarily considered harmful, but concentrated areas of irregularities are considered defects.



Burrs produced during milling . . .
of core edges to desired contour causes fillets to form on the burr instead of the ribbon during brazing, reducing panel strength markedly. This condition shows in a radiograph as a dark line adjacent to, and parallel to, the ribbon, with a white or light line (the fillet) parallel to it in turn



Unbrazed panels . . .
are shown up by the lack of fillets and uniform density of the ribbon that indicates no flow of the brazing alloy. In this small test panel, which has gone through the complete brazing cycle, tack-braze spots and sheets of alloy where they are butted together are still visible



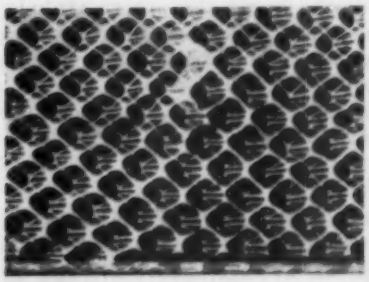
In production . . .
one portion of a panel may be brazed, another not. Here is a radiograph of such a condition

Curved components present a more difficult problem than do the flat or wedge-shaped panels and require a more refined and precise technique. It has been found that when radiographing this type of panel, a focal distance approximately the same as the radius of curvature of the panel is more satisfactory than extended focal distances. A cell in the central beam of radiation may be perfectly defined, but to either side of this point, because of curvature of the panel, the angle between the cell and beam of radiation changes, causing the fillets of the upper surface to overlap those of the lower surface. When a focal distance approximately the same as the radius of curvature of the component is utilized, the angle that the beam of radiation makes with the cells remains almost the same over a large area because of the conical shape of the emitted X-ray field.

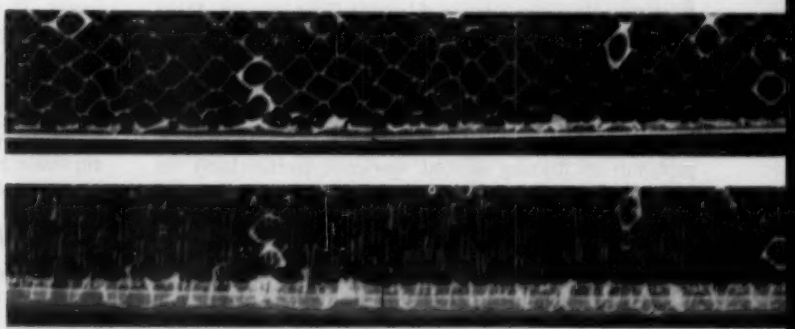
Wedge-type honeycomb construction presents still another problem, caused by tapering of the honeycomb from as much as 6 in. in thickness to a feather edge. The maximum sufficiently defined area per radiograph is diminished to a few square inches, because of this increased thickness. Each individual wedge panel requires its own X-ray technique, primarily because cell orientation varies from panel to panel inasmuch as most cores are spliced together from smaller cores.

As an aid in the interpretation of X-rays, the Process Control Department has issued a Radiographic Evaluation Guide. This guide includes radiographs like those shown of various conditions. X-rays have been verified by sectioning individual panels.

Other means of inspection, such as the impedance tester, vibration methods, and heat test methods have not been found to produce consistent and reproducible results. Further modifications or other methods which are cheaper may be eventually developed. The only other method which does show some promise and which is cheaper is the fluoroscope or some modification thereof. The only disadvantage is that it does not provide a permanent record. It could be used to segregate poorly brazed or defective panels and save the cost of further processing and X-raying.

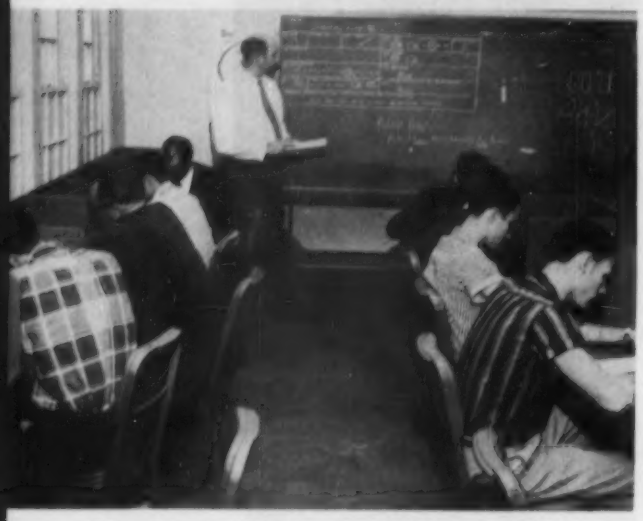


Internal voids . . .
are caused by slippage or poor fit of internal members. Here such voids are visible near the internal doubler, which slipped during assembly and produced a series of voids on both edges of the core



Absence of a braze . . .
between the edge member and the core is obvious when the core is separated more than ⅛ in. However, if the core is up against the edge member but not brazed, it is much more difficult to see unless a special radiograph is taken perpendicular to the edge member. It is not practical to X-ray components in so many directions, however, so the reviewer must be trained to distinguish critical details

Here Are the Keys to Success . . .



Key 1: Do Thorough Aptitude Testing

Initial testing of applicants at Temco's employment office indicates which men are likely to make good machine-shop trainees. James H Norman, Temco testing specialist, explains forms used in aptitude testing

Key 2: Parallel Study with Shop Work

The "readin', writin' and 'rithmetic" of the machine shop are studied 4 hr a day by student machinists. Class work is concurrent with work as a helper on a machine with an experienced operator

. . . as "Forced Responsibility"

From the street to operating complex machines may take only three months at Temco. The answers: careful selection, fast schooling, "take it or leave it" assignment of responsibility

E J TANGERMAN, executive editor

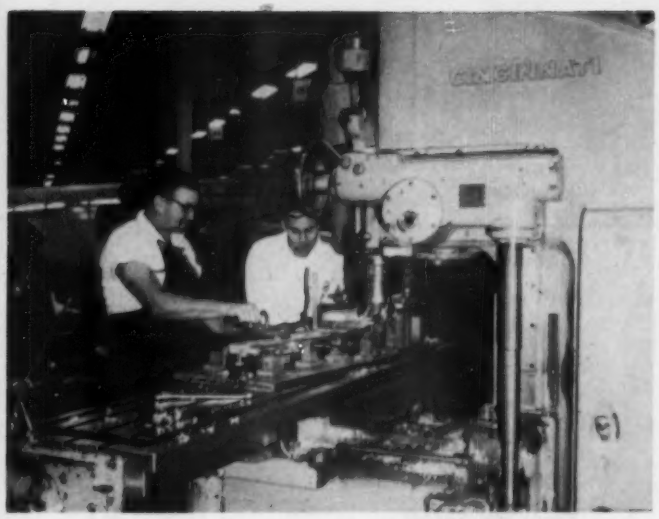
Five months ago, Temco Aircraft Corporation, Dallas, had in its machine-shop crew over 60% with less than a year's experience, and 39% with less than 16 weeks. The result of rapid growth and the increasing shortage of workers, either trained or ready for training, this condition typifies the widespread problem of finding skilled workers, particularly in rapidly growing industrial areas.

The unusual thing about it is that Temco isn't crippled by the problem. The company has developed its own accelerated method of training machine operators, based on careful initial selection and a fast, planned teaching method that has men operating their own machines in two weeks—even operating complex equipment like skin mills on quality parts in three months.

According to P F Young, superintendent, the problem has existed over the past seven or eight years. It soon became apparent that a major improvement would be to eliminate *at the start* the "borderline" man who hasn't the proper attitude, mental alertness or mechanical comprehension to handle a machine-shop job. Simple tests were applied to weed out unsuitable applicants. The acceptable minimum is placed a little higher than the national standard for machinists.

ABOUT THE TESTS . . .

There is always a problem in using tests. Which tests will do the best job in determining whether an applicant will be an average, above-average, or below-average performer in his new job? To get the answer to this question, the Training Department and Machine Shop supervision got together and selected the test areas and factors they felt would be significant. Specific tests were purchased or devel-



Key 3: Train With a Skilled Man
O J Colbert (right) observes the technique of setting up a casting for machining as instructor-operator; B N Jarnagin locks the work in a milling fixture

Key 4: Assign Personal Responsibility
After five or six weeks of half-day classes and half-day work as a helper, the young operator takes over his own machine, with full responsibility for the job

Trains Operators

oped to measure those traits. The preliminary test battery included two mental-alertness tests (one commercial and one Temco-developed); one commercial mechanical-comprehension test, and one commercial personality test which measures objectivity, agreeableness, and cooperativeness.

These tests were administered to all applicants for machine-shop jobs over an extended period of time. Later, a follow-up study was made to determine the Temco "batting-average" on applicants hired.

Machine-shop supervisors were asked to rank more than 300 employees. Standard scale scores, assigned to their rankings, were used as criteria for evaluating the tests. These tests indicated that the chance of obtaining an above-average performer could be improved by selecting applicants within certain test-score ranges. These ranges have been the criteria in the selection procedure since that time.

There have been some surprising discoveries as the program has developed, among them the very practical one that some machinists are by temperament and dexterity unsuited to shop work! *Selected* "green" men have in a surprisingly short time surpassed some men with many years of experience but who are less suited to shop work. Also the "old-line" machinist is usually excellent at tooling because of his wealth of experience and "know-how," but this very wealth may make him impatient with routine production work. He feels—and quite properly—that he "knows too much."

Basically, the theory behind the Temco program is that of forcing responsibility on the new man. He is started as a helper with an experienced man—the time-honored method—until the next official class starts. Then he goes to school 4 hr a day, taking simple arithmetic through shop trigonometry and a little geometry, fractions and decimals; blueprint reading; safety; precision measurement; and like essential subjects (see schedule). In two weeks, with this supplementary training, he begins to operate his own machine.

After five to six weeks (100 hr) of this combined training and practice, the course is completed, and the man moves to the night shift to work on his own. From then on, his progress depends on his observation, willingness to accept responsibility, and eagerness to learn from the old-timers, most of whom are supervisors. (The few 10-year men are almost all supervisors.) The system is one of "forced responsibility"—he does his own thinking, makes his own setups (there aren't enough setup men in the area either).

Responsibility is also given to, and clearly understood by, the supervisors as well. They run their

"Forced Responsibility" Trains Operators . . .

MACHINE-SHOP

TOPICS	TIME (HOURS)
Introduction	
Orientation—Machine-Shop Superintendent	½
Orientation—Instructor (Shop organization, schedule, books, tools, subjects, wage structure, qualifications in shop and class work, etc)	1
Films "Stop Waste" (1st); "Safety" (2nd)	½
Make Outside Text Assignments	½
A. Mill B. Turret Lathe C. Drill Press D. Grinder	Issued according to classification
E. Math F. B/P Sketch Books	Issued to all
Decimal-Equivalent Card	1
A. Explanation B. Practice (Tap Drills)	
Shop Terms and B/P Abbreviations (This is a very important topic generally under-rated.)	4
Hand Tools	1
Film: "Use and Care of Hand Files"	½
Precision Measurement	2½
Film: "Tools and Rules"	½
Machine Tools	1
Cutting Tools	1
Work Holders and Attachments	1½
Standard Machine Tapers	½
Aircraft Metals—(SAE, AISI and AMS)	1
Heat Treat and Hardness Testing	1
Film: "Hardness Testing"	½
Feeds and Speeds	1
Film: "Alloy Steels"	¾
Thread Terms	1¾
Film: "This Is Aluminum"	½
Aircraft Standard Parts	½
Release of Machine Parts	½
Scrapped Parts (What To Do)	½
Film: "This Is Magnesium"	¾
Keeping Notes on Difficult Jobs	¼
Basic Math	8
A. Decimals (Practice in addition, subtraction, multiplication and division)	
B. Conversion of Common Fractions	
C. Stated Shop Problems	
D. Square Root (To be used for third side of right triangle)	

own cleanly separated areas, getting help only when they ask for it or its need is clearly indicated. Thus a supervisor, at his own discretion, can—and has—put a 3-mo man on the skin mills—where the cost of material worked alone may be $700 to $1000 on a given setup.

Under normal circumstances, such a setup would be backed by an elaborate methods department, producing detailed methods sheets. But, here again, there is a shortage, so available men must be "spread thin." Temco, as a subcontractor, produces some 3500 different machined items, almost all on a job-lot basis—quantities are too small for continuous production. Instead of detailed methods sheets, the shop is subdivided into a series of smaller shops, each complete in itself, even to tool-grinding. Each of these shops specializes in the work of one or several prime contractors, so its men become skilled in that kind of work. They learn to read a particular type of blueprint and work to a particular set of tolerances. (As both blueprint conventions and tolerances vary widely with the prime contractor, this could be a stumbling block otherwise.) Greater versatility and initiative result than if the man were subjected to all kinds of jobs with no similarity.

This program, and its success, have led to some

TRAINING SCHEDULE

TOPICS	TIME (HOURS)
Plane Geometry	8
A. Basic Rules	
B. Polygons	
C. Geometry Problems	
Basic Trigonometry	10
A. Issue and Study Trig Tables	
B. Reading Practice	
C. Trig Formulas	
D. Solving Unknown Angles	
E. Solving Unknown Sides	
F. Solving Completely (All unknowns of basic trigonometry)	
Trigonometry in the Shop	10
A. Trigonometry in B/P	
B. Diagramming Complicated Problems	
C. Geometry Applied to Trigonometry	
D. Accumulation of Error in a Series of Trig Problems	
E. Oblique Triangles	
F. Interpolation	
Basic Blueprint	20
A. Perspective, Isometric, and Orthographic Projection	
B. Alphabet of Lines	
Films: "The Drawing and the Shop" (1st) "Behind the Shop Drawing" (2nd)	
C. Rotation of Views	
D. Practice with Blocks	
E. Isometric Sketching	
F. B/P Sketch Book (Third view, missing lines and isometric)	
G. Machine Trades B/P	
H. B/P Symbols and Conventions	
Shop Blueprints	18
A. Title Block	
B. Bill of Material	
C. Notes (specific and general)	
D. Zones	
E. Changes and Forms Used by Different Companies	
F. A/C Reference Lines	
Film: "Sections and Conventions"	
G. Use of Operations Sheet	
H. Practice Reading (Machine Shop B/P)	
I. Interpreting Customer B/P	
J. Criticism of Course	
Film: "Productivity, Key to Plenty"	1
Total	100

surprising thinking at Temco. One facet, for example, is that machinist apprenticeship may be too lengthy just for machinists—that it is suited more to toolmakers and potential supervisors. After all, the usual apprenticeship starts with a great deal of training and a very little practice, shifts to more and more practice and less and less training. For ordinary machinists, why not skim off the training portions and give them in concentrated doses to men selected in the first place for their ability to learn? The Temco rotation program for development of potential foremen has already demonstrated its ability to pick out potential supervisors and potential engineers, and these men are singled out for further training if they are willing to take it. Also, the program develops some men of unusual versatility, who can handle any job, just like the old-line machinist. These men, too, are singled out to advance as rapidly as they can take it.

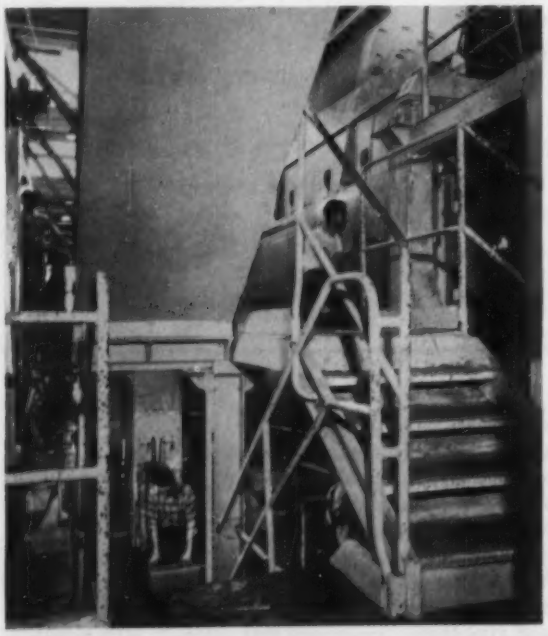
There are never enough men of any skill, never enough engineers, never enough supervisors, so responsibility is loaded upon new men to develop them rapidly. This is a "take it or leave it" training method that brings to the top the men who can take it—which may, after all, be the secret of finding supervision in any plant.

Stairway railings . . . are made from galvanized 1 5/16-in. welded steel tubing and several of eight stocked Nu-Rail fittings. Only special work required here was bending a few curves, as at top of stairs. Design work is minimized because most cases can be covered by specifying the number of sections of each type required

Standard scaffolding saves $500,000 on KC-135 contract

No more special orders; no more scrapping when the job is finished. Standard tube and fittings are assembled on the spot in quick time to make any shape or size of scaffold needed for high work on aircraft frames; even make stairway and catwalk railings at Boeing Airplane Co, Seattle, Wash

Scaffold requirements . . . depend on floor load expected. Columns are 2½- or 3-in. steel with six types of ends. Steel floor-beam supports are 6-in. I-beams or 4-in. T-beams in 10- or 20-ft lengths. Flooring is standard plywood sizes. Scaffold floors are 8 or 16 ft above plant floor



Old railing, . . . even disregarding paint chips, looks bad by comparison, and cost much more to plan, design, assemble, and erect. New units take about 3 min per fitting for assembly; old ones around 50 min.

Round Table

Beat — On His Own Time

"Why don't you leave Hanson alone, Ed? So what if he does have a part-time job at night? The company can't control what the men do after they leave here."

"Look, Al; the reason I was bawling him out is because he comes in here in the mornings so dead tired. That's no good for him or for the company. Suppose he ruins a big piece of work because of that night job? You think we shouldn't have something to say about it then?"

"I suppose so, but then's the time to make an issue of it; not now. If he can keep up his work, it doesn't matter what he does on his own time."

"I don't agree, Al. I was telling him for his own good. Oh, I know he needs the extra money, with his big family to support. But the trouble is he may get into trouble on his main breadwinning job because of a piddling little extra cash he earns on his time off. It doesn't make sense."

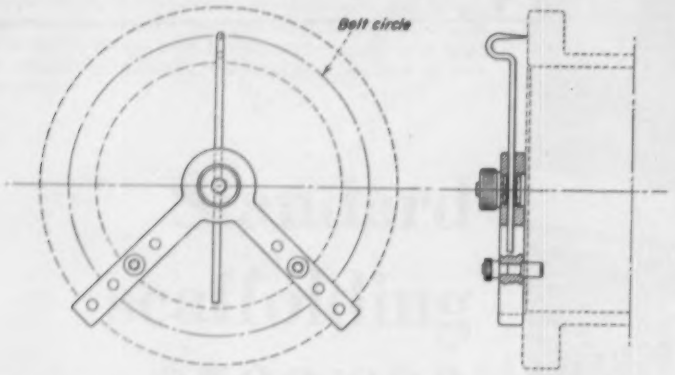
"It makes sense if he can keep up the pace, Ed. You claim you're trying to make him stop for his own good; but he should be able to judge what's best for himself. Besides; you don't get after Murphy, and he sure gets himself beat on his own time. He must walk ten miles every night, between bars; and he's sure sleepy in the morning."

"Yeah, but I've already had it out with Murphy about that. Just one bad job and out he goes—and he knows it. But I don't think Hanson realizes that he's liable to wear himself out this way."

"Let him find out for himself, Ed. You can't convince him anyway."

***SHOULD** Ed keep after Hanson, or let him alone? Does a company have the right—or responsibility—to look after its employees even during off hours? Your ideas on the subject may be helpful to others.* *Discussions of earlier topics start on page 212.*

Practical Ideas . . .



Bolt Circle Scriber Simplifies Layout

Layout work of bolt circles on tubes, flanges, and work of similar nature, that is, work without center part, generally require more time in preparation than the actual working time. Because the drilling operation usually follows the turning operation was reason enough for making this simple device. Application can be made either in the bore of a flange or on the OD, whichever is more convenient.

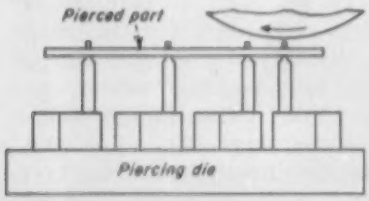
Two adjustable guide pins on the rectangular-shaped body are set for the ID, as illustrated. Then the scriber is adjusted to the required bolt circle, which is marked off. A bolt circle so laid out represents definite concentricity with the ID. Tool can be set for production layout work, and about 200 pieces can be turned out without correction under ordinary conditions.

The construction of the scriber body is not complicated. It is laid out to form two legs at 90° to each other, converging in a hub. A series of holes are drilled and reamed in each leg at equal distances from the center of the hub. These are to receive two guide pins which are inserted from the bottom, and secured by knurled nuts from the top.

The hub is bored out to accommodate the locking device. The locking principle employed resembles to a great degree that used in locking the scriber of a surface gage. This is one of the most positive means of securing the scriber without marring it.

As the scriber is interchangeable, the tool with different shaped scribers can be used in a number of other applications where a line has to follow an edge.

Dirk G Nolle, Montreal, Canada



Product Prevents Vibration In Punch Grinding

Punch grinding is most conveniently done while they are still mounted on the die. Long, small-dia piercing punches, however, are difficult to grind this way because of the vibration created.

When our punches need resharpening, we use a part pierced by this die, and place it on the punches. This distributes the force placed on one punch to all of them, preventing vibration and eventual breakage.

It should be borne in mind that the holes must be snug around the punches. If any are loose fitting, it is easy to shrink a hole by peening. We do this by first placing the part on a flat surface. A steel ball is located on the hole to be shrunk and given a light tap. This is usually enough to close a hole to produce a nice fit.

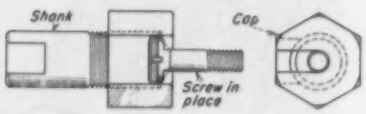
Buckley Sullivan, Cleveland, Ohio

Greased Lamps Come Out Easier

Maintainance men who must replace burned out lamps may have found that corrosion has affected the metal parts, making removal difficult. We have discovered that this is particularly true in places where acids or some types of gases are used.

Before we install a new bulb, after having broken many in trying to force them out, a little grease is placed on the threads of the brass base. The next time it has to be removed, the job will be much easier.

Charles Shutt, Alma, Mich



Chuck Holds Flat-Head Screws

This chucking fixture holds flat-head screws while we do turning, cutoff, and drilling operations on them. We even use it to alter ends to take swivel bases.

It's made in two parts: The shank and the hexagonal cap. The shank is threaded about half way, and a slot is milled in the forward end for a small key that is silver soldered in place. Two flats are milled on the blank end to provide for gripping in a vise, though the fixture's primary purpose is for use in a chuck or collet.

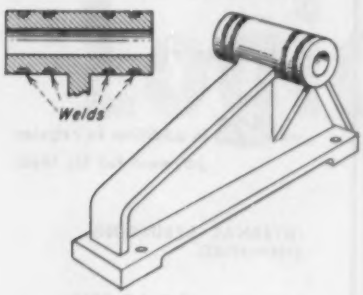
The hexagon cap is bored out and threads are cut to fit the shank. The bottom is machined to the body size of the screws to be held, combined with the taper of the head. A T-slot is milled in from the side to allow insertion of the screws.

The cap is threaded onto the shank and chucked in the lathe. It's loaded by dropping the head of a screw into the T-slot and locating it on the key. The cap is then tightened until the screw is held. Two turns are usually enough to remove a screw.

The problem that gave birth to the idea for this fixture was the job of extending the threads all the way to the head.

Clifford Molloy, Bronx, NY

Practical Ideas



External Welding Saves Oversize Bore

It happens in the best of shops; somebody makes a mistake, and a piece is ready for the junk pile. We found ourselves in this predicament recently after finishing a large stanchion. The bore was 0.003-in. oversize; not much, but too much to receive a bearing already finished.

It was here that one of our welders came to the rescue. He remembered that in welding around a hole there would be a shrinking effect.

Feeling that we had nothing to lose, for it was impractical to open up the bore to bush it, we prepared the casting for welding. Four deep grooves were ground around the bearing boss, two on each end. The grooves were then filled with several passes of arc-welding.

The excess weld was ground off flush with the periphery of the boss, making the weld practically unnoticeable.

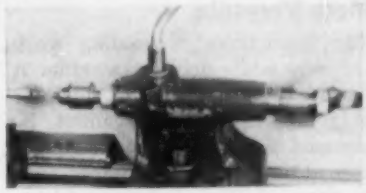
Because of the difference in thicknesses and the supports, linked with expansion and contraction, the bore was slightly out of round but small enough to allow us to carefully clean it up to size. It had shrunk an average of 0.007 in.

Buckley Sullivan, Cleveland, Ohio

Knob Replaces Handwheel For Better Sensitivity

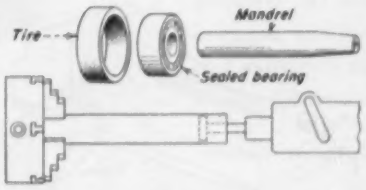
Handwheels on tailstock spindles are often not sensitive enough for feeding small drills. The illustrated knob can be quickly made and installed in place of the handwheel to increase sensitivity.

The knob is machined as shown and tapped to suit the thread that normally takes a retaining nut. A bushing of approximately the same length as the handwheel hub is made to fit loosely on the shank. A headless setscrew is used to jamlock the knob once it has been screwed on against the bushing. This eliminates the need for keying the knob to the feedscrew.



With this arrangement a small drill may be fed into the work by "feel," in much the same manner as feeding a sensitive drillpress. Brakeage because of overfeeding is considerably minimized.

H J Gerber, Stillwater, Oklahoma



Tailstock Support Helps Cutting Light Tubing

We recently had the job of cutting 30 rings of 2-in. stainless steel. The wall thickness was only 0.075 in. and the length tolerance was ±0.003 in.

The material supplied to us was in two lengths of over 30 in. each. This meant we would need a steadyrest, which we tried without success. The tubing vibrated as soon as a tool was applied, and it made cutoff impossible. And when the steadyrest jaws were tightened to eliminate vibration, they marred the exterior of the tubing.

It therefore seemed logical to support the work from the inside. This was done with the adapter shown. A length of shafting was turned to a taper at one end to suit the tailstock spindle. The other end was fitted to an enclosed ball bearing carrying a tire, the OD a snug fit inside the tubing.

One end of the tubing was plugged and chucked in a universal chuck, and the outboard end supported by the mandrel.

After the end of the tubing had been squared off, we set out to cut the rings using a standard cutoff tool. When three or four rings had accumulated, the mandrel was removed from the spindle to allow the rings to drop off. This was necessary because the burrs raised on the rings prevented removing the rings over the tire.

Buckley Sullivan, Cleveland, Ohio

Weaker Hooks Solve Disappearing Light Problem

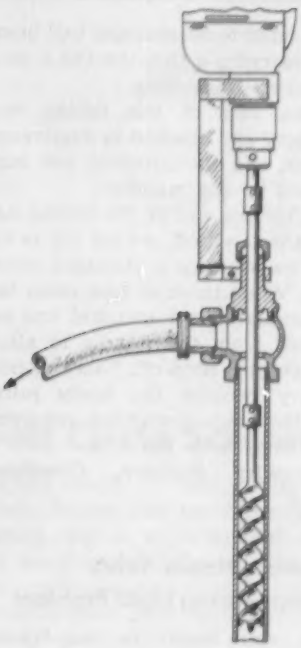
The steel hooks in our trouble lights were too strong. This was evident every time a light was left hanging on a truck or trailer by one of our mechanics. When the truck would leave so would the light head.

After several light heads were lost this way, this nuisance threatened to become expensive. Therefore, all steel hooks have been replaced by new ones made of soft copper wire. Now, when a light is forgotten on a truck, the result is not so disastrous. If a truck should take off with a light hanging on its side the copper hook will straighten out, leaving the light head behind.

After this simple alteration, our toolcrib has been better supplied with trouble lights.

Charles W Shutt, Alma, Mich

Practical Ideas



Emergency Pump Made From Auger Bit

We had a breakdown in our plant and needed a pump in a hurry. With nothing on hand that looked like a pump, we were forced to use what materials we had. The end result was gratifying and we have since then used it for bailing liquid out of drums.

We began by screwing a length of pipe into the pressure side of a ¾-in. angle valve. A 13/16-in. auger bit was perfectly suited for the pipe's ID, leaving only about 0.006-in. clearance all around. The disc and stem of the valve were removed and discarded, but the packing gland retained.

The square shank of the auger bit was cut off and coupled to a heavy-duty rubber hose for flexibility. The hose was secured in both ends by small pins going through outer metal sleeves, the hose, and the shafts, transmitting the power from an electric hand drill. A bar with a clamp at each end held the drill and valve housing in line. The packing was adjusted to allow a free fit on the shaft. Any leakage here drips back into the tank.

A short length of garden hose was attached to the outlet side of the valve. This hose should be of as large an ID as can be accommodated to relieve back pressure.

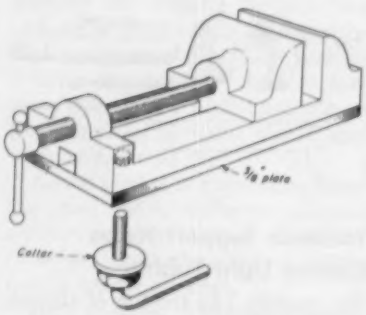
This arrangement does not confine the hand drill; it can easily be removed and used on another job by just loosening the clamp and drill chuck.

Clint McLaughlin, Queens, NY

Drillpress Vise Made More Versatile

The importance of holding work securely while drilling, whether it be by strapping to the table or gripping in a vise, cannot be stressed too much. Straps or c amps can, at times, be quite cumber ome, so proper holding is often neglected. We found this situation existed in our shop, and here's what we did about it.

A good drillpress vise was chosen for this arrangement. We fastened a flat ground plate to the bottom of the vise with four ¼-in. hollow-head capscrews. This was



to enable us to locate a ⅜-in. tapped hole near the screw-handle end, and centered.

We made a locking handle by cutting a thread on a ⅜-in. rod. At a point on the blank part of the rod it is bent at right angles. A jamnut is run up on the thread, followed by a thick threaded collar, jamming both at the end of the thread.

The threaded part of the handle is passed through any of the slots in the drillpress table and screwed into the hole in the base plate. Locating the vise in any desired location is from here on relatively simple.

Leo Kucheck, Newark, NJ

WINNER NO. 260

G O EVERETT

won $25 in addition to regular payment for his idea:

INTERNAL DEBURRING SIMPLIFIED

in the issue of Oct 8, 1956

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y

Logic functions...

KEY TO METALWORKING CONTROL

WILLIAM M STOCKER, JR, associate editor

SIGNALS are the one common — and apparently indispensable — ingredient in all industrial controls; in fact in all controls including those determining the functions of the human body. But what, exactly, is the relationship between a signal and the action it controls? How can a signal, or a combination of signals, contribute to a positive decision? Knowing this, we have both an important method for solving problems in automatic operation and process control, and a major device for finding the most direct method of control.

Logic functions are the answer. And only four simple functions provide the basis for all control decisions. What these four functions are, where they are used, and how they are combined into both simple and extremely complex controls is described in this report, written for the man in the shop.

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American Machinist

SPECIAL REPORT NUMBER 436

How you make a decision!

A logic function is simply a means of expressing a definite condition. Curiously, only four logic functions are required to express any possible condition, set of movements, or specific arrangement of information. These functions are: AND, OR, NOT and MEMORY. The definition for each of them can almost be deduced from its name.

In the "AND" function an output signal is produced only when *all* of a given number of input signals are applied. In other words, given input signal a *and* b *and* c *and* d *and* . . . . . j, the *AND* function delivers an output signal—causes some action to occur.

In the "OR" function an output signal is produced when *any one* of a number of input signals is present. Hence, given any input a *or* b *or* c *or* . . . . . j, the *OR* function delivers an output signal.

With the "NOT" function, an output signal is obtained only when *no* input signal is present. Therefore, given an input a, no output occurs; but stop input a and the NOT function delivers an output signal.

"MEMORY" is the fourth function. Actually, there are two kinds of MEMORY functions—a *limited* function and an *unlimited* function. Limited memory means that, following an input signal, there is a specified *time delay* before an output signal is obtained—or after which no output is produced. The unlimited memory function delivers an output following an input signal until a second input is fed into the system; the second input stops the output. This function "remembers" the last signal fed in and responds accordingly. Thus, given input a, the unlimited memory function delivers an output *until the next signal,* input b, is applied.

What does all of this mean? Well, to give you an idea of the really basic nature of logic functions, many scientists believe that the human mental process behaves in logic function fashion. Any decision, whether as simple as "will I walk or drive" or as complex as "shall I change my way of living," and even the reflex action, is analyzed and determined by these functions.

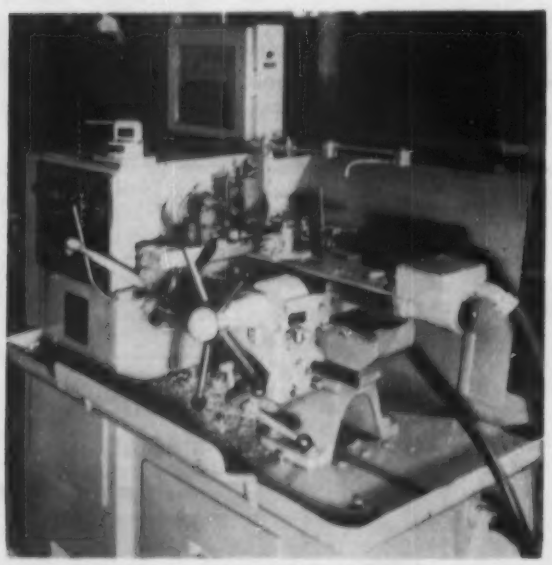
Either a series of conditions, a choice of conditions, a negative influence, the memory of a previous experience, or a complex of the four functions, will decide the action you take. However, a single decision may involve variations of these four functions repeated thousands of times until all of the factors (inputs) are sifted down to the final *output*—your decision. This process may take only a fraction of a second or many hours and days.

In operating a machine tool by hand, the machinist's every action is determined by these four logic functions occurring in his thought processes. Knowledge and experience simply determine which elements must be present and which functions to use. Thus, for automatic operation of the machine the functions processed by the brain are handled by an instrument. These instruments *cannot "think."* They only make decisions based upon information previously placed in them and the arrangement of the decision-making elements.

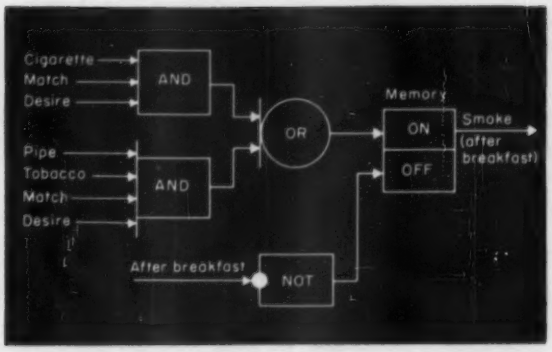
Logic functions are not new. Even aside from the mental processes, they have been performed (though not always recognized) by electrical relays for years —since relays were introduced in 1836. The AND function, for instance, is accomplished by placing relay contacts in series. The OR function is nothing more than relay contacts in parallel. Normally closed relay contacts provide the NOT function, and MEMORY results from the well-known latched-in relay. Logic functions have also been accomplished through electronic-tube circuits and transistors in addition to magnetic components. Logic functions might also be handled mechanically by the use of cams and ratchets, hydraulics, or pneumatic devices.

Signals are the information carriers which make up both the quantity in which operations must be performed and the means by which operations can be performed. Signals are amplified, transmitted, or switched. They are also used to actuate control mechanisms and to match systems or sections of systems. In so doing, signals form the basis of industrial control.

Signals actually take one of two forms: "analog" or "digital." Electrical systems, equipment, and



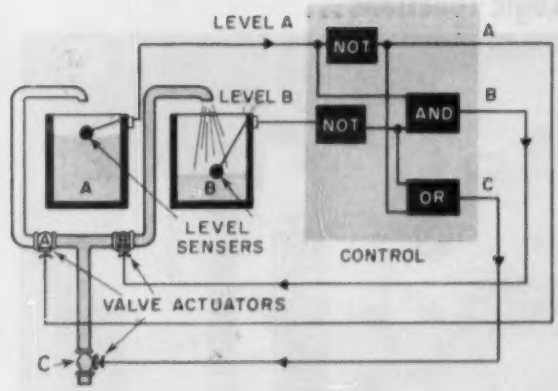
Electro-Cycle automatic turret lathe . . .
by Warner & Swasey, is controlled by Cypak logic elements. Programming is done by setting toggle switches seen behind glass enclosure above headstock. Logic elements and power amplifiers are mounted on the inside of doors of the control cabinet, which is at the base of the machine, rear. Designed for turning small diameter barstock and, especially, for short runs, this system establishes spindle operation for each of six turret faces. Sketches of the toggle switch arrangement for each job can be furnished the operator as part of job tooling



Should you smoke?

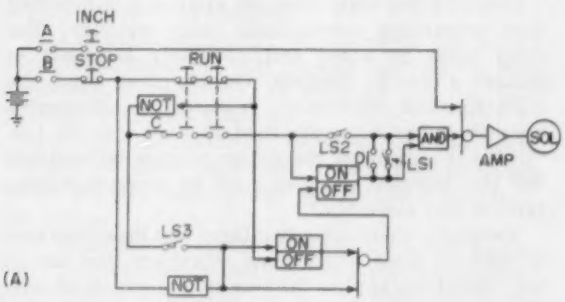
Logic functions not only can be used to meet any control problem, but are involved in processes of all types. As an example, look at the logic process involved in a man's decision to have a morning smoke, and programmed with logic elements. To smoke a cigarette, the man must have the cigarette AND a match AND the desire to smoke. Thus, an AND element with three inputs is required. But, the kind of smoke is not specified so a pipe must also be considered. (This man doesn't smoke cigars until after lunch.) Again, he must have a pipe AND a light AND tobacco AND a desire. This time a four-input AND element is required. However, our friend will not do both at once, hence to select one or the other, we must feed the outputs of the two ANDs to an OR element. Like most men, however, this man will NOT smoke before breakfast. Here a NOT element is required to produce a signal at all times when no input (breakfast) is present.

Now with the output from the OR we can supply an "On" signal to a MEMORY element and with the output from the NOT we can supply an "Off" signal to the same element. Thus, we get an output from the MEMORY—and consequently a smoke—only after the man has had breakfast. Some scientists claim that the mind performs these functions in arriving at every decision

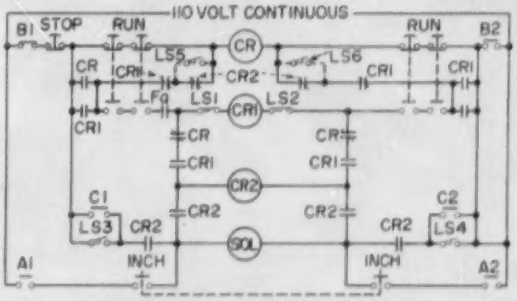


Controlling flow

Two tanks in a central coolant system must be filled in a specific sequence. Tank "A" must be filled first and tank "B" can be filled only if tank "A" is full. The tanks are at opposite ends of the plant. The sensing elements are level sensers in each of the tanks, which deliver an output when the tanks are full. Immediately, the characteristic of the level sensers suggests that a NOT element must be used to detect when the tanks are not full. Hence, the inputs from the two level sensers should be fed to two separate NOT elements. But the stipulation is that tank "B" be filled only when tank "A" *is* full and when tank "B" is *not* full. Thus, the output from the NOT element associated with tank "B", and the output direct from the level senser for tank "A", should be put through an AND element. This part of the control says, if "A" is full AND "B" is not, "B" will be filled. A common valve is also added, which will also operate when either "A" or "B" is empty. This means an OR element fed by outputs of two NOT elements. Problems of this nature can be solved by simple, commonsense logic, without either the help or the knowledge of Boolean algebra



(A)

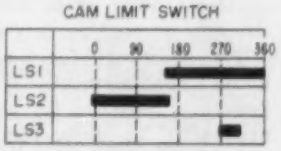


(B)

SELECTOR SWITCH

SWITCH	INCH	RUN	OFF	CONT
A	●			
B		●		●
C		●		●
D				●

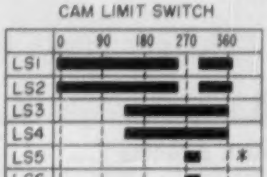
CAM LIMIT SWITCH



SELECTOR SWITCH

SWITCH	INCH	RUN	OFF	CONT
A1	●			
A2	●			
B1		●		●
B2		●		●
C1				●
C2				●

CAM LIMIT SWITCH

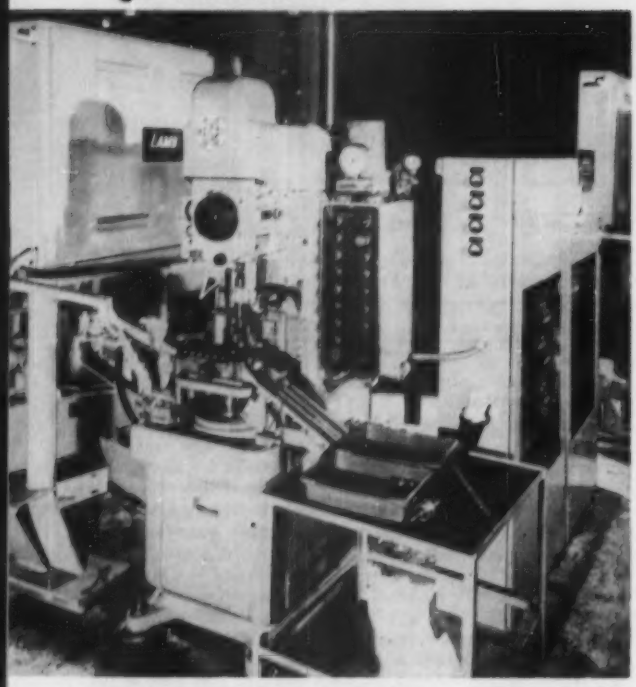


** Jumper or limit switch required if "ON HOP" operation desired.*

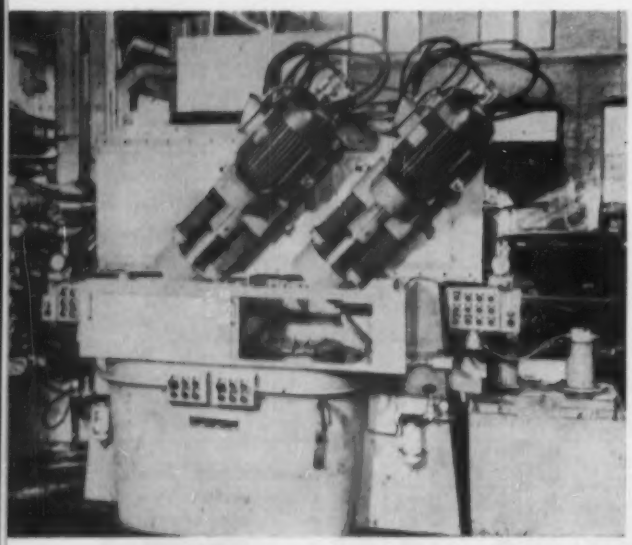
Punch-press control . . .

is more complex, hence direct translation from control requirements to logic circuits becomes more involved. The logic circuit "A" can be designed by translating from the relay diagram "B", by considering the relay equivalents of AND, OR, NOT, and MEMORY. However, the use of Boolean algebra would provide not only the most convenient method of designing the circuit, but also the most positive method of reducing control to the least number of components

Logic functions...



Automatic precision honer . . .
feeds, aligns, sizes, gages, sorts, and segregates parts, as well as indicates available abrasive at any time and shuts down machine when abrasive is consumed—all through the logic function programming made possible by logic elements



Finish grinding . . .
of the hub on torque converter impeller assemblies for Ford automatic transmissions is done on a number of Springfield grinders equipped with logic-element controls. While there are no conventional control relays, each of the eight Cypak circuits feeds a preamplifier which controls a single-pole, heavy-duty, midget relay. The relay, in turn, controls the solenoid of a hydraulic valve. Operator simply places part in chuck and presses the cycle start button to put the machine through its automatic sequence. The cycle includes clamping, grinding, size control, wheel dressing, and shut off

even design approaches are largely classified under these two headings. While logic functions are primarily concerned with digital control, a description of the two systems may minimize future confusion.

As the name connotes, the "digital" signal is a single, sharp, discreet signal of definite duration—a pulse. The "analog" signal, in direct contrast, is continuous, and gives a continuous representation of (is analogous to) some quantity or process. The signal from a switch is digital; the signal from a tachometer generator is analog.

Positive measurement, for instance, is achieved by counting pulses in a digital system whereas most measurement obtained through analog signals can only be approximate. When small quantities of information are to be handled, analog systems are cheaper but as the quantity of information increases so the cost of the analog control increases. When large quantities of signals must be handled, digital controls are considerably less costly. Use of techniques such as binary-number counting further reduce the quantity of equipment required.

Practically all machine tools and most other metalworking equipment receives some measure of *digital* control through logic-function systems. Most of today's "giant brains"—computers, calculators, data processors, numerical control systems, and automation devices—operate by means of logic functions.

New control approach

While these functions are not new, the use of *the logic-function approach to designing industrial controls is new.* This discipline opens vast areas of understanding for tomorrow's manufacturing systems. It cannot safely be ignored.

Learning the logic function approach is involved with unlearning conventional relay methods. The relay must be wired and purposely arranged to achieve a specific function. On the other hand, the logic function mechanism requires no adjustment because it has been designed to do a specific job. Thus, not only must the design process be modified but also physical changes must be made in manufacture and assembly.

Naturally, there are advantages and disadvantages to both of these approaches. However, the use of logic functions applies the true fundamentals of control. The designer is able to solve more complex problems, solve them more efficiently, and greatly simplify present circuits and circuit concepts.

Typical of logic function devices are the Westinghouse Cypak elements. The Cypak magnetic control system is designed for use with the logic function approach. To date, applications of this system, placed on the market only about two years ago,* have provided the major portion of information describing this new concept.

** General Electric's Industry Control Department has just announced the availability of its new "Static Switching Systems." This equipment, using static-magnetic and solid-state devices to perform a variety of control functions, provides another source of Logic Function elements, having no moving parts, for use in this new concept of control. These, too, are complete systems built around plastic encapsulated plug-in units for the AND, OR, and NOT decisions.*

The name CYPAK, applied to Westinghouse logic elements, stands for packaged Cybernetics—CY for Cybernetics and PAK for package. These elements are definitely a replacement for relays, but not on a one-for-one basis. Relays accept only one input, and provide a number of isolated outputs. Cypak elements, conversely, accept a number of inputs and provide a single output. This output can be used, however, for a number of functions.

No moving parts

Unlike relays, these magnetic elements have no moving parts, contacts, springs, or other elements subject to wear or erosion. The result is a tremendous increase in control life and reliability as well as in the positiveness of the signal. Similarly, the magnetic element is powered by alternating current and will emit a signal once each half-cycle; hence conventional 60-cycle current will provide as many as 120 signals per second.

If necessary, a 400-cycle system could be designed with special elements, to give 800 signals per second —or 800 definite actions. And even greater signal frequency is possible.

From a cost standpoint, the magnetic-element system usually is more expensive on an installation-cost basis and considerably less expensive when maintenance and replacement are considered. However, costs vary. For simple control systems, relays are much cheaper. When the control system becomes complex, and reliability is important, a magnetic-element system may actually cost less to install than a relay system.

Where do you get magnetic-element systems and who works out the logic-function program? There are three principal methods:

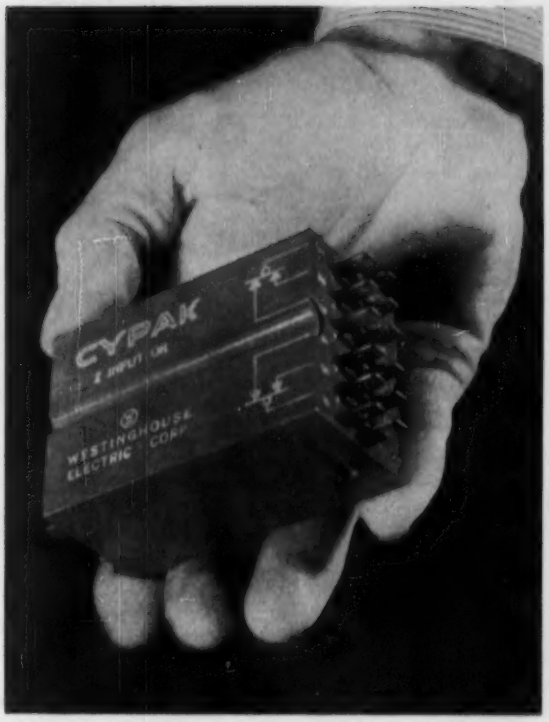
1. The manufacturer of the elements can supply them from stock and will provide training for your engineers, if necessary, in working out the logic function programs you need.

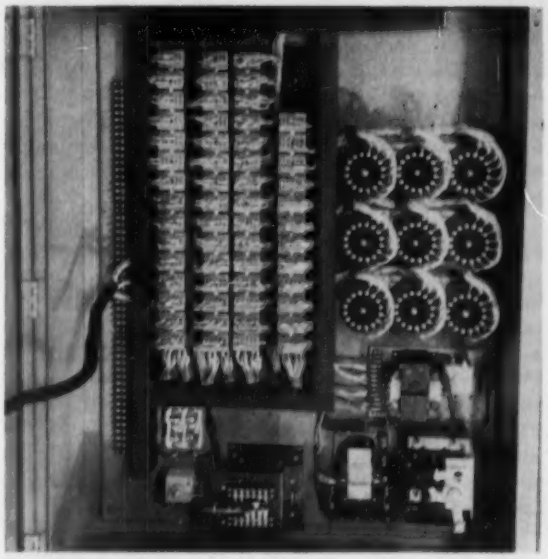
2. Complete systems can be worked out for you by the manufacturer and even installation provided. However, this may involve an additional engineering charge.

3. In ordering certain machine tools and equipment you can specify that magnetic-element controls be supplied. Generally, it is less costly to install these systems on original equipment than to modify existing equipment.

While magnetic elements do not require electronic tubes, transistors, or similar devices, they do require an input transformer and an output power supply. In the Cypak system, one logic power supply has adequate capacity to supply 150 logic blocks, or elements.

All Cypak logic units, AND, OR, NOT, and MEMORY, are supplied individually sealed in solid polyester blocks, with power connections at one end for plug-in to a special power channel, and input- and output-signal terminals at the other end. Each unit contains a printed logic diagram to simplify making connections as well as checking circuits. Even though the "OR" units do not require power connections,





Control cabinet . . .
shows typical logic element arrangement. Wires are readily available for changes or replacement. While the plug-in logic blocks (top) cannot be repaired (they are sealed-in-plastic units), they are readily removed and replaced. Each block is marked to show its function, direction, and internal circuit arrangement

Logic functions . . .

they are supplied in the same plug-in block design as other elements.

How logic functions are used

Logic, according to Webster, is the "connection, as of facts or events, in a rational way"; also, "The *science* that deals with the canons and criteria of validity in thought and demonstration." Use of the principles of logic makes it possible to determine the "one best way," or more than one way when more than one way exists, to accomplish any action —and to do so by scientific procedure. These principles of logic, or symbolic logic, are akin to mathematics, but they are ont mathematical in the full sense.

Actually, logic is the science of argument. The transformation of words and sentences into symbols illustrates vividly the confusions and ambiguities of ordinary language, how they are uncovered by logical analysis, and eliminated by the methods of symbolic logic. The symbolism is borrowed from mathematics. Symbolic logic is far too weighty and complex a subject for discussion in the space here available. Nor is it necessary to understand this science to make use of logic functions as represented by magnetic logic elements. Nevertheless, it is a science which is becoming more and more imperative for the engineer and, particularly, tomorrow's engineer and manager.

Who, more than metalworking management, could better use a method for analyzing an idea, an operation sheet, a job description, or a new process evaluation that results in a rational answer? The theory of logic is intimately connected with that of language. But how can you create symbols for language that will lend themselves to mathematical balance and analysis?

George Boole (1815-1864), an English mathematician and logician who taught for many years at Queens College founded the modern study of symbolic logic. Out of his work, plus contributions by many other famous logicians, was founded *Boolean algebra*. It establishes the logic functions and provides a method of logical analysis. According to Boole's pamphlet, *Mathematical Analysis of Logic*, "The mathematics we have to construct are the mathematics of the human intellect." Surprising as it may seem to some people, most of our thoughts can be classified.

For instance, the word "AND" is a connective, hence each time it is used it represents a multiple thought; a compound condition. In Boolean Algebra, the word "AND" is given the algebraic multiplication sign (·) as a symbol. Similarly, the word "OR" represents choice, an *additional* thought, thus it is symbolized by a plus (+) sign.

If a given condition is considered as standard and labeled "A", then its opposite is NOT standard and the minus (–) sign is placed above the symbol thusly: $\overline{A}$; the "NOT" condition. $\overline{A}$ is also the complement of A. Boolean algebra, as used here, takes no account of time or sequential relationships, hence the "MEMORY" functions are added to the control circuitry after the algebra is established.

With the foregoing symbols, the condition is expressed. Values are expressed with numbers and descriptions are symbolized by letters such as: A, B, C, . . . X, Y, Z, etc, with a different character used for each distinct class or function.

Applying Boolean algebra to relays, the contacts can have two states, "open" or "closed". Thus each contact has two possible values. When it is closed it has infinite admittance, and, when open, zero admittance. (Just as a door, conversely, when open, will let everyone through and, when closed, no one gets through.) These two values, infinity and zero, are represented by "1" and "0" respectively. *These are the only values needed to solve a logic-function equation.* Electrical values are introduced only after the pattern of functions has been determined. This is based on the "concept of admittance."

Now we are in a position to picture more readily the factors which determine a control decision. Knowing the description, value, and condition of each element, the postulates and theorems of Boolean algebra make it possible to determine the most logical arrangement of elements to fulfill a need. The technique can be applied to any control problem, though its use is limited as described above.

Remember, you do not have to understand Boolean algebra to use logic-function elements, or to design your own control systems. However, for highly complex systems it can be most helpful in simplifying the design process. Also, for companies that do wish to design their own systems, Westinghouse can provide a Cypak problem simulator which includes multiples of all of the elements plus a power supply. It permits arranging and checking practically all circuit possibilities.

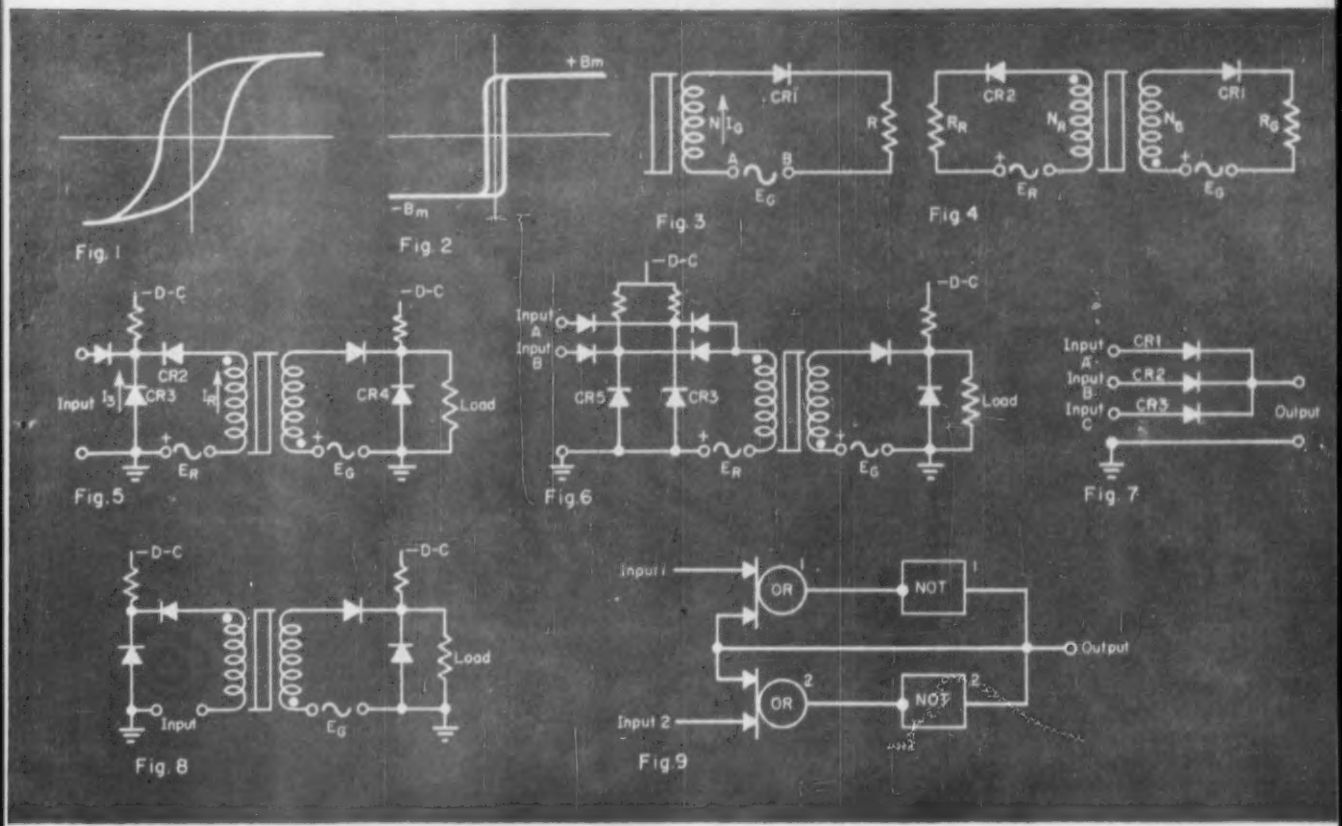
Many types of equipment are now controlled by these logic-function elements. On Micromatic Hone Corporation's Model 738 Microhoner, a completely automated machine which generates a bore square with the end faces of a piece, to provide accurate locating surfaces for subsequent operations, Cypak controls these operations:

1. Automatic feeding and aligning of parts.
2. Automatic sizing.
3. Automatic after-gaging via standard air spindle and pneumatic-to-electric transducer.
4. Automatic segregating of parts, according to bore diameter, as they leave the machine.
5. Automatic stone-wear indication.
6. Automatic shut down when abrasive is exhausted or if a predetermined number of parts are out of tolerance.

Decisions by magnetism

Cypak logic elements operate primarily on magnetic amplifier principles, but with the addition of the Ramey circuit. Because of the wide hysteresis loop width (or B/H curve), lack of squareness, and lack of sharp saturation point, conventional transformer steel is unsuitable for use in magnetic amplifiers. However, with the development of grain-oriented magnetic alloys, the ideal, approximately

Logic functions



square, hysteresis loop required for self-saturating operation became a reality. The two different loops are shown, Fig. 1 and Fig. 2.

Hypernik V, patented by Westinghouse, is an alloy of approximately 50% nickel and 50% iron. With its curve or "loop", a slight change in H can produce a great change in B. This property is the basis for the logic-element circuitry.

Using this material in the circuit shown (Fig. 3) and applying ac voltage E_G, exciting current I_G will flow through the coil when terminal A is positive. With proper values of E_G and N (turns of the coil), I_G will be just sufficient to drive the core of Hypernik V to saturation during this positive half cycle. The core cannot absorb any more voltage. In the next negative half cycle, the rectifier prevents flow of current, hence at the start of the next positive half cycle the core remains saturated. Because the core cannot absorb any more voltage, there will be a voltage across the load R. However, the output of this system is not controlled.

Development of the Ramey circuit (Fig. 4), by addition of a reset circuit, provided a fast response magnetic amplifier. A further improvement to this circuit, the addition of dc bias voltages in gating and reset voltages (Fig. 5) provides a one-input AND element—that is, an input to the element will produce an output.

In the 2-input AND circuit (Fig. 6), rectifiers and dc bias voltage are provided for each of the input circuits. Thus, both inputs are required to develop an output. If either of the inputs is missing, reset of the core will be accomplished through the biased rectifier (CR3 or CR5). Thus input A *and* input B must be present to supply an output.

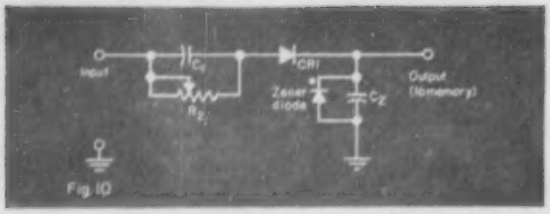
A 3-input OR circuit (Fig. 7, which produces an output when there is an input to any one (or more) of the input terminals, is the simplest of the logic elements. Rectifiers CR1, CR2, and CR3 provide isolation of the input signals. Here, input to A *or* B *or* C, or any combination thereof, will produce an output signal.

The Cypak NOT circuit is very similar to the one-input AND circuit. E_R is eliminated, and the terminals normally used for the voltage E_R are used as the input terminals to the element, as shown in Fig. 8. An output signal is produced whenever an input signal is NOT present.

MEMORY is essentially an information storage device. An input applied at the ON terminal develops a known output condition, which continues even though the input signal is removed. If an OFF signal is now applied at the other terminal, the circuit switches to a different output condition and remains in that condition until an ON signal appears. Two OR circuits are combined with two NOT circuits to provide the MEMORY function, as shown in Fig. 9.

On applications where it is essential that a MEMORY circuit remembers its previous state, regardless

Logic functions...



of power supply interruptions, an additional circuit may be included. This unit is called a retentive MEMORY, and operates with the MEMORY circuit shown.

Frequently, proper system operation calls for a delay period between the time when an input signal is received and the time that an output is produced. This condition is obtained by the addition of a time-delay element to a MEMORY circuit which feeds its output into input 1 of the MEMORY circuit, Fig. 10.

Output of the Ramey magnetic amplifier is a half-wave voltage. Proper operation of AND, NOT, or MEMORY circuits requires voltage of proper phase and polarity to accomplish or prevent reset of the amplifier core. For these reasons, it is necessary to consider *phasing* in Cypak logic systems.

The phase notations "Ø" (phi) and "θ" (theta) are defined as the alternate half cycles of the supply frequency in which the supply voltages have these instantaneous polarities:

1. Sinusoidal ac voltages are positive going in the phase of their notation.

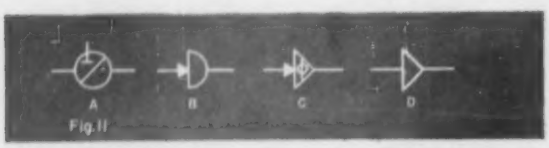


Fig. 11 . . . Cypak symbols and the comparable relay symbols shown in *Fig. 13* provide a basic guide for converting a relay system to logic-element control. Additional Cypak symbols include: (A) transformer unit to convert original 115-volt input to 15-volt input; (B) delay element; (C) pre-amplifier; and (D) amplifier

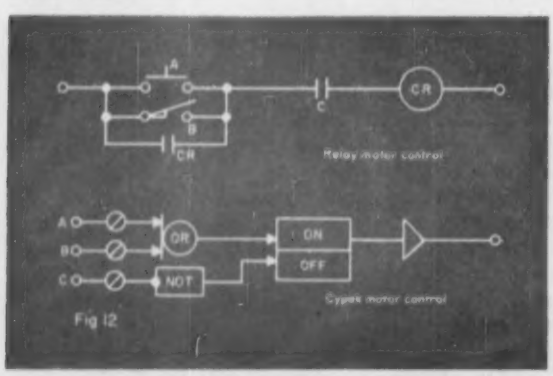


Fig. 12 . . . Comparison of motor controls for same application, using relay circuit and logic-element circuit. Relay circuit involves a pushbutton, a limit switch, a relay, and a contact on the relay as a holding circuit. The logic-element circuit accomplishes the same function

2. Half-wave dc output voltages are positive going in the phase of their notation.

3. Half-wave bias voltages shall be negative going in the phase of their notation.

Thus, in an AND unit, with "θ" inputs, output will be "Ø", and vice versa. In a NOT unit, with "θ" input, output (when there is no input) will be "Ø".

What does it mean?

Logic-function control offers a step forward in the concept of modern manufacturing. Tomorrow, and even right now, one of the major problems of automatic control will be the maintenance requirement. Another important problem will be control packaging; getting all of the equipment necessary for automatic control in a sensible amount of space. Add to these the problem of designing complex systems and you begin to appreciate the advantages offered by this new concept.

Thus, these control systems provide another link in the chain of technological events which offer humanity the opportunity of wiping out drudgery and living in a world only dreamed of a few years ago.

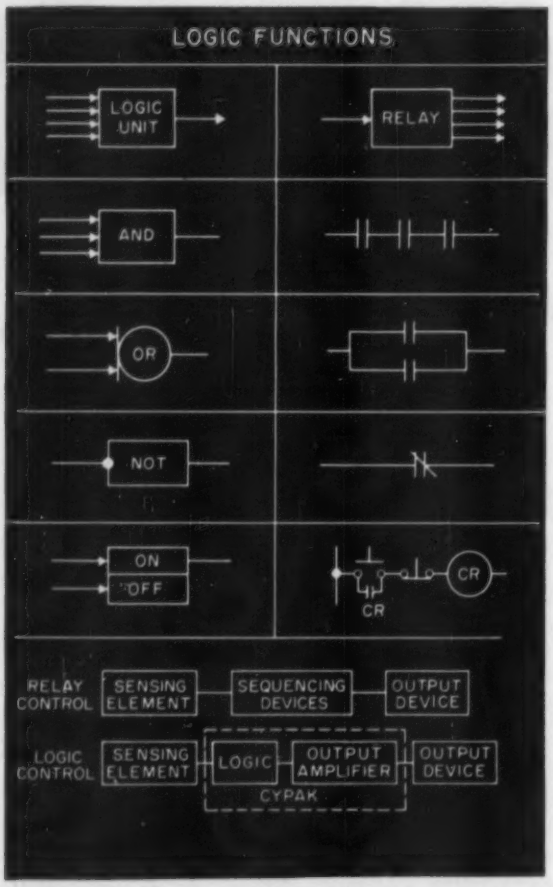


Fig. 13 . . . Logic functions are performed by relays as well as by the more recently developed logic elements. Here the symbols, not to be confused with logic symbols, for the two types of units are shown side by side. These symbols are used to develop control networks

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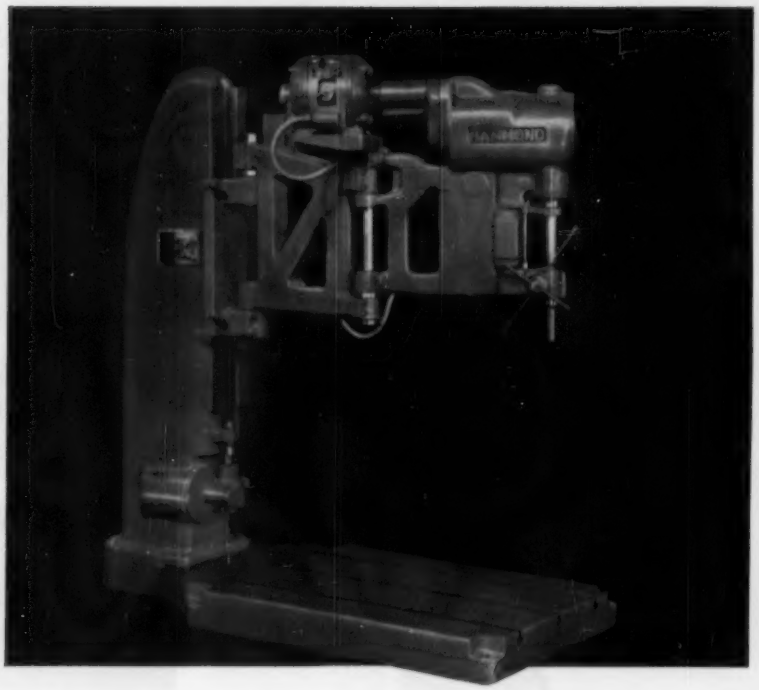
FOOTBURT
FOOTBURT



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■ Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

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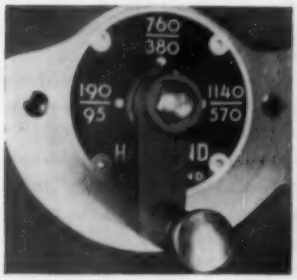

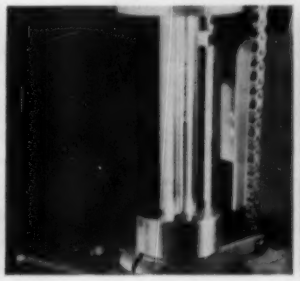

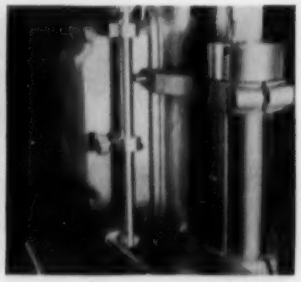

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Nicked Gear Tooth

Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

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Patents pending

7631

POSITIVE KNOCKOUTS AND STRIPPERS . . I

ALLAN YOUNG, tool design engineer,
COLLINS RADIO CO, CEDAR RAPIDS, IOWA

FIG. 1

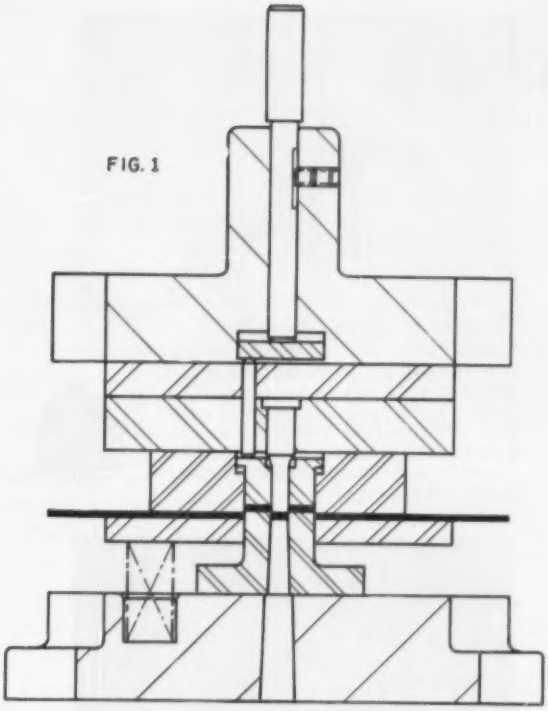


FIG. 2

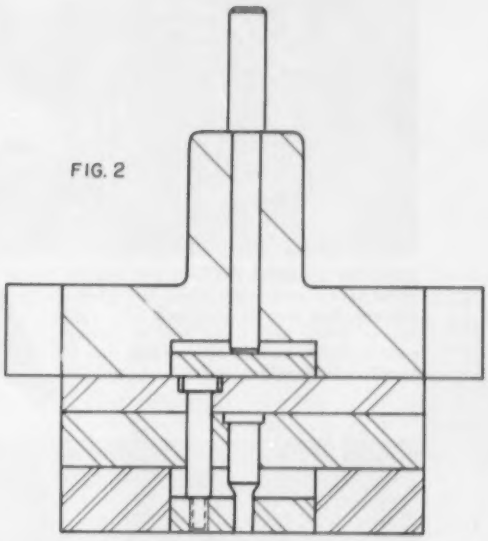
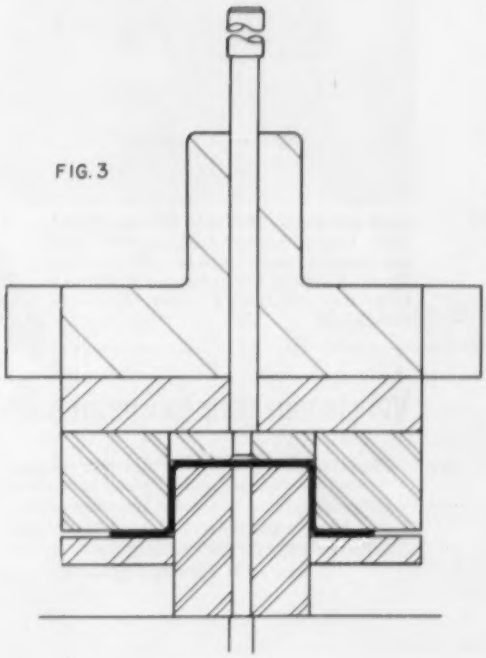


FIG. 3



Here are some of the most practical methods of building mechanical stripping devices for dies. Fig 1 is a positive knockout typical of small compound dies. A shoulder is machined on the shedder to retain it, and the upper die block is counterbored to fit this shoulder. Because piercing punches must clear the knockout, a cavity is machined in the punch-holder to accommodate a small plate. From this plate, a spider arrangement of three or more pins extends to the top of the shedder.

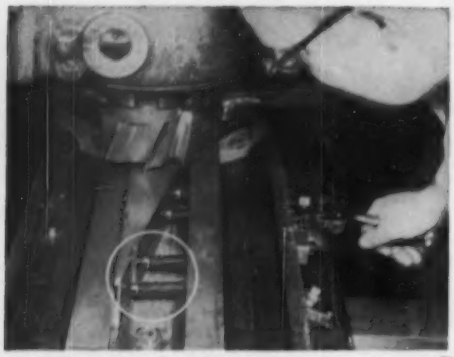
The same type of die for larger parts is shown in Fig 2. In this case, three or more stripper bolts replace the spider pins shown previously, and these bolts also retain the shedder.

A simple method of retaining the shedder involves peening over the end of the knockout rod, which has been turned to a smaller diameter and pressed into a hole in the shedder. See Fig 3. The hole in the shedder is countersunk on the bottom side for peening. This method of retaining the shedder is recommended only for lighter stripping operations, such as the draw die illustrated.

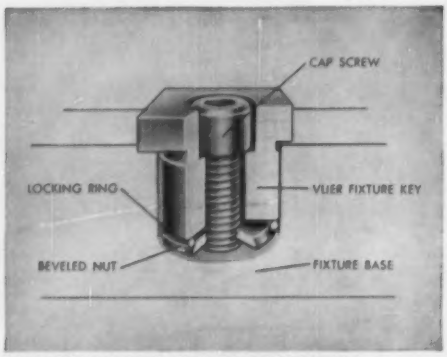
Please turn to page 149.

What can be done to lower YOUR tooling costs?

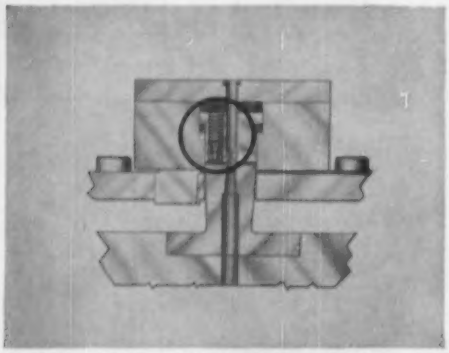
Thousands of companies are making drastic savings by using standard Vlier Tooling Specialties instead of costly custom-made substitutes. The applications shown below are only the *obvious* uses for these simple, inexpensive tooling specialties.



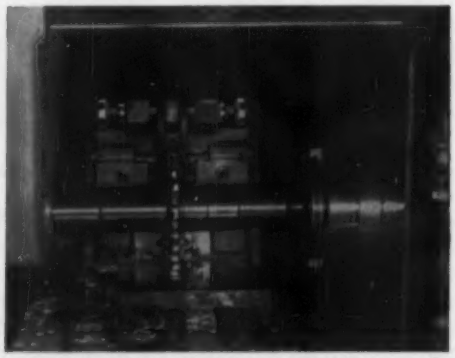
CLAMPING OFF-ANGLE PARTS in jigs and fixtures is a cinch with Vlier Swivel-Pad Clamps. Pad swivels on a ball, 7½° each side of center line. Can't bind or damage part surface. Socket set models can be inserted from either end.



NEW FIXTURE KEY WITH INSTANT-ACTING, INTEGRAL LOCK eliminates unnecessary drilling and tapping operations to mount keys in fixture base. Holds key securely, permits quick change of key size for different table slots. Insures perfect alignment of jigs and fixtures on table.



NEED ACCURATE, UNIFORM SPRING LOADS? Vlier Spring Plungers really pay off when positioning parts in jigs and fixtures. Spring loads are accurately set at the factory; stay constant. Plunger telescopes completely.



THE RIGHT AMOUNT OF CLAMPING PRESSURE AND NO MORE! There's no distortion of the part when Vlier Torque Thumb Screws are used to clamp it in the jig or fixture. Once predetermined end pressure is reached, the head turns freely. Working parts are protected from foreign matter.

Where can your tool room save?

Chances are, you can think of dozens of uses for standard Vlier Tooling Specialties—applications where expensive, complicated, home-made devices are now being used. *Why not write for your copy of the new 1956 Vlier catalog today?*

Originators of small parts that make a big difference in tooling costs!

VLIER ENGINEERING INCORPORATED

8900 Santa Monica Blvd., Los Angeles 46, California

POSITIVE KNOCKOUTS AND STRIPPERS . . II

The composite drawing, Fig 4, illustrates two ways to use positive knockouts for stripping formed parts. The left side shows how a pin strips on the edge of the part and the right side how a pin strips on the inside of the part. In either case, two or more pins would be used, an equal number on each side. In this type of die, the part need not always be stripped completely off the punch. In the case of longer formed sides on the part, complete stripping would be impossible. Instead, if the part is pushed down far enough to insert a screw driver between it and the punch, the part can be pulled off by the operator.

Fig 5 shows a positive stripping device used where the material is too heavy and the stripping pressure is too great for practical use of springs. The stripper is mounted on springs and retained by stripper bolts to assure correct alignment and flatness, but the actual stripping is done on the upstroke of the press by four connecting rods attached to the stripper and activated by a stripping bar in the punch-holder. Stripper travel is controlled by adjustable jam nuts at the top of the connecting rods. The blank is ejected by a conventional positive knockout. Press stroke and width of ram are of extreme importance in building this type of stripper, because the connecting rods must clear the ram, and the press stroke determines the setting of the jam nuts at the top of the connecting rods.

FIG. 4

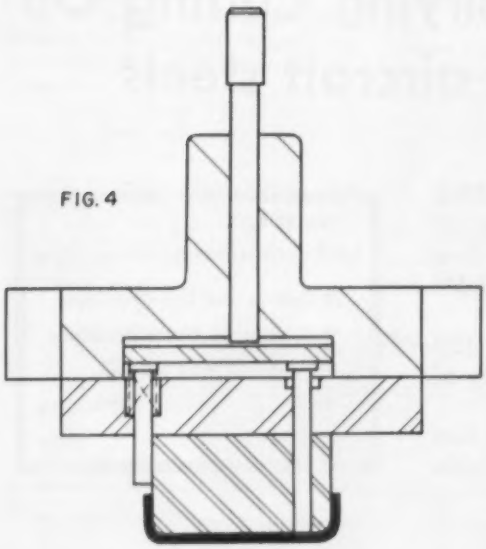
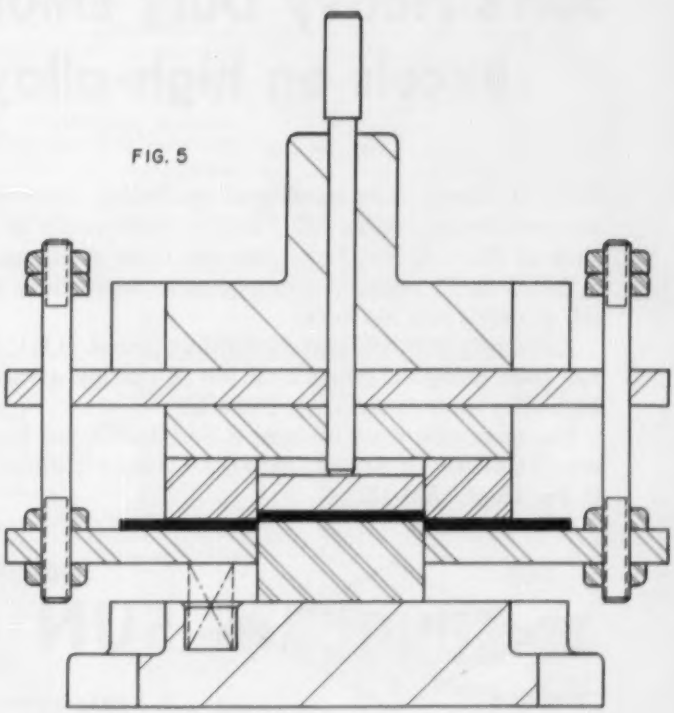


FIG. 5



Sun's Heavy Duty Emulsifying Cutting Oil excels on high-alloy aircraft steels

S.E.C.O. Heavy Duty handles all machining jobs requiring an emulsifying cutting oil. Piasecki Helicopter's large job shop at Morton, Pa., found this out three years ago when S.E.C.O. HD* replaced two expensive heavy-duty soluble oils in machining fan hubs.

Extremely versatile and moderately priced, S.E.C.O. HD has been doing an exceptional job in cutting a variety of high-alloy aircraft steels for Piasecki.

For more information about S.E.C.O. HD, see your Sun representative. Or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-12.

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American Machinist REFERENCE BOOK SHEET

SLEEVE-BEARING ALIGNMENT

R J SOLLOHUB, manufacturing engineer, GENERAL ELECTRIC CO, FT WAYNE, IND

Excessive friction losses and bearing failures can be prevented if shop men and designers consider the basic reasons for tight-running shafts. In many cases, boring or reaming operations at assembly can be omitted without opening up bearing-to-shaft designed clearances.

Three possibilities for shaft-bearing interference are illustrated in Fig. 1. The most important factor is bearing angularity, although this is the most usually omitted tolerance dimension:

$$C = L_b \left(\tan \theta + \frac{e}{2D} + \frac{S}{2} \right)$$

Where C = bearing clearance*
L_b = bearing length**
Tan θ = bearing angularity as in Fig 1 (D)
e = Concentricity error, total indicator reading
D = Distance between bearings
S = Shaft runout, in. per inch

Angle θ is difficult to measure; it is usually expressed as runout in 0.001 in. per unit diameter on the face of the bearing assembly, or W/D, where W = total indicator reading and D is equal to the diameter swept by the indicator.

Example:

Consider a shaft 10 in. between bearings. Total shaft runout is 0.003, or 0.0003 in. per inch of bearing length. Eccentricity of bores is 0.003 in., and W, commonly called wobble, is equal to 0.003 in. on a 5-in. dia. Then:

$$C = \left[\frac{0.003}{5.000} + \frac{0.003}{20} + \frac{0.0003}{2} \right]$$
$$= 0.0006 + 0.00015 + 0.0015$$
$$= 0.0009 \text{ in.}$$

By eliminating all concentricity and shaft runout error, C would be reduced by only 0.0003 in. If bearing angularity, only, were corrected, the clearance required would be reduced by 0.0006 in.

The greater the distance between bearings, the less effect concentricity error will have. Shaft runout is only pertinent within the bearing length and is generally easy to maintain. Bearing angularity, however, is harmful regardless of distance between bearings.

In Fig 2, concentricity is dependent on both endshield and motor frame. Bearing angularity is dependent on squareness of endshield faces and parallelism of motor faces. Thus, the faces of the frame should be machined at the same time on an arbor, and alignment of the machine heads to maintain parallelism is more important than concentricity of bores. Endshield faces should be machined after the bearings have been inserted, by finish boring the bearing or by a qualifying cut locating from the finished bore. The endshields should be designed so that clamp bolt pressure will not distort them.

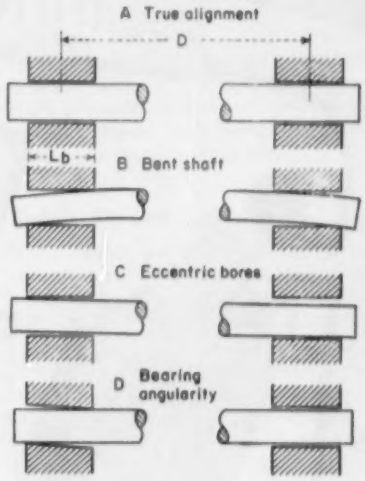


Fig 1

Fig 3 shows a typical gear train, where parallelism of the two endplates and assembly of the bushings are critical. If the bushings are not machined true and assembled true, to fit them and maintain alignment will be almost impossible. The OD of the bushing should be turned with a step lead as illustrated, and the bushing should be pressed in square.

Ordinary commercial arbors should not be used to qualify motor-frame rabbets or to turn OD'S of bushings. These arbors generally have from 0.001 to 0.0015 in. taper per inch, which will be reflected in bearing angularity. Step-type arbors ground in 0.0001 in. increments are best.

*This is not bearing design clearance, which depends on many factors such as rpm, load, material, etc., but is only the clearance necessary to prevent shaft and bearing interference

**Because clearance is directly proportional to bearing length, shortening the bearing length will reduce clearance requirements. This possibility is not considered here

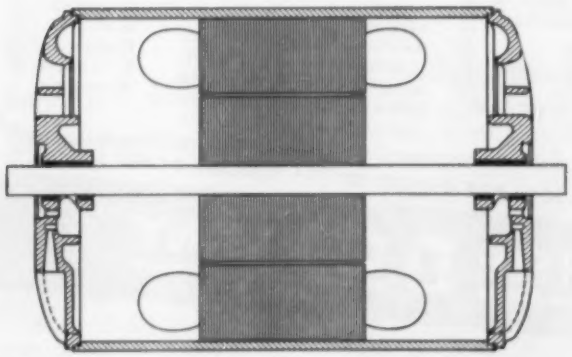


Fig. 2

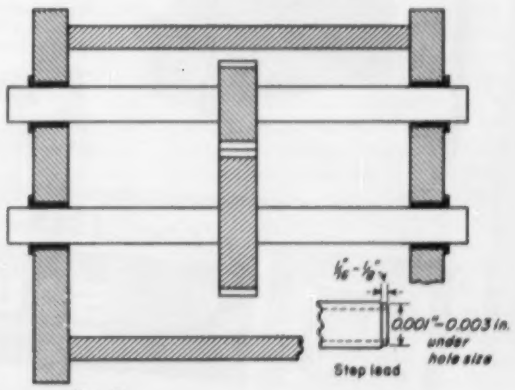
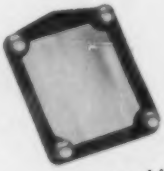


Fig. 3

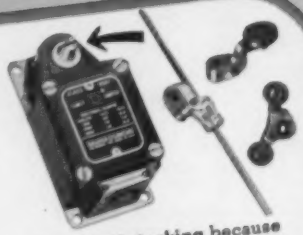
SQUARE D LIMIT SWITCHES

DESIGNED TO DO HUNDREDS OF JOBS... Better!

Instant visual inspection of mechanism through transparent plastic cover (optional). A tremendous time saver in multiple switch installations.



Eleven contact arrangements in one switch...and all you need to make the changes is a screwdriver!



Simplified stocking because basic switches and a wide variety of lever arms are packaged separately. Moderate stock handles a multitude of combinations.

Continuously adjustable operating lever arms permit an infinite number of adjustments. Up to 80° overtravel reduces arm breakage.

Easy mounting and interchangeability through wide variety of base plates and side mounting holes.

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SMALL
OIL-TIGHT
Class 9007, Type A

Roller arms are available in a wide range of designs and lengths.

Small precision limit switch available in three forms—basic contact mechanism, flush or surface mounting. Both flush and surface mounting switches are available with varying lengths of roller arms and with rollers of different types and sizes. Also push rod operated (*shown above*) and in single unit or duplex construction.

Write **for Bulletin 9007** *which gives the complete details of Square D's complete line of oil-tight limit switches*

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Talking Shop . . .

Nuclear Lubrication

CALDER HALL, the world's first atomic power station, has 60 control rods that must slide in and out of the reactor. Lubricating the control mechanisms requires an oil that will resist radiation and can operate in an atmosphere of dry carbon dioxide. Molybdenum disulfide was found to be the solution. A varnish developing a film of molybdenum disulfide was developed by Rocol, Ltd. For even worse conditions in the reactor, Rocol has developed a silicone varnish containing MoS_2 that resists abnormal conditions of moisture and corrosion.

Concrete-filled Engine

ABOUT THIS TIME every year, with a look at the steep grades in our town, and the leaden skies above, we pack the trunk of our car with rocks to improve traction. Thus we weren't surprised to learn that the Chicago and North Western railroad has used a 45-ton block of concrete in an engine-conversion program. A worn-out diesel-electric was modified by removing the engine and generator and installing the concrete. Coupled to a regular engine (which supplies power to the drive motors of the concrete monster), it provides additional traction in starting heavy trains. When the train reaches 10 mph, the booster cuts out automatically.

Sabotage in West Allis?

FIVE LATHES WERE DAMAGED in the West Allis works of Allis-Chalmers recently. A cup of iron chips and a cup of abrasive had been placed in the motor-oil reservoir of each lathe over the weekend. On starting work Monday morning, the operators saw their machines grind to a halt. The FBI solved the case in a couple of days: A man whose job it was to haul the chips away from the machines said they went too fast for him and he just wanted to slow them down. The workers in the plant were incensed at the sabotage and cooperated with the FBI, said Allis-Chalmers. We see a moral in the tale, though: When you have fast, automatic machines, you had better investigate automatic chip disposal.

A Safer Solvent

AN ALMOST UNKNOWN SOLVENT, methyl chloroform, looms as a safe substitute for the dangerous, but necessary, carbon tetrachloride. Maximum concentration in the air for 8-hr exposure is 500 ppm compared with 25 ppm for carbon tet. General ventilation is adequate for brief exposure. Process ventilation is required for elevated temperature operation. The technical grade of methyl chloroform reacts violently with unoxidized aluminum, but several commercial sources offer a stabilized grade that eliminates this undesirable property. A guide sheet on the healthful use of the new solvent is available for 25¢ from The American Industrial Hygiene Assn, 14125 Provost, Detroit 27, Mich.

Chuck Jaw Inserts

A CHUCKING PROBLEM arose in cutting off automobile brake drums. The drums are held on a 14-in. chuck on a Bullard which operates at 258 sfpm with a 0.015-in. feed to cut off five or six drums a minute. The swivel jaws wore rapidly under the heavy chucking pressure until inserts of Haynes Stellite alloy No. 3 were mounted in each jaw. The inserts last 40 to 50 days on two-shift operation.

Walking Foremen

THE AVERAGE FOREMAN spends almost 20% of his time acting as a messenger according to a survey reported by Jerome S Underhill to the recent ASME meeting. Although the survey was made in the Chemical Division of Merck & Co, the findings should be a warning to many metalworking plants. Only about 25 to 30% of the average foreman's time was spent in direct supervision. Aside from messenger duties, they spent 10 to 15% in clerical work, and 10% working with fellow supervisors. As a result of corrective measures the amount of time available for direct supervision was increased by 40 to 50%. This was done by transfering much of the routine to clerical help, by a loudspeaker system that cut communications time a third, and by reassigning certain 100% inspections that had been made by foremen so they would be handled by inspection groups.

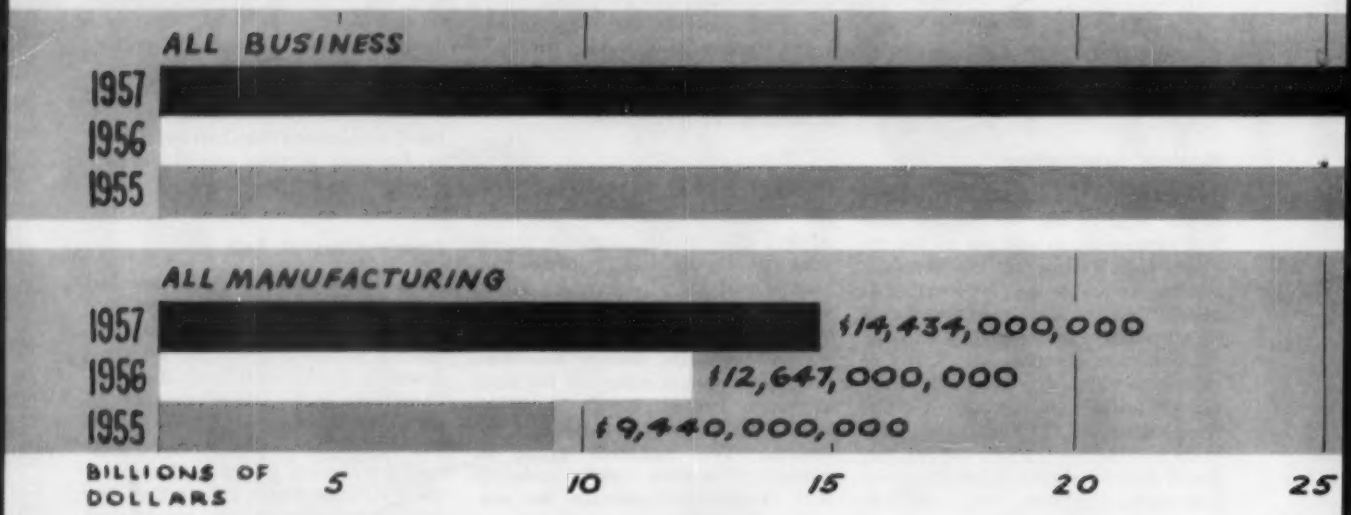
Cole's Crystal Ball

NINE AREAS that offer the greatest potential for the future in the auto industry were listed by Ed Cole, manager of Chevrolet Div, in a recent speech at the University of Michigan. They are: new power plants and transmissions, new metals or metal-like materials, synthetic fuels, synthetic material, the use of nuclear energy for research and testing, the use of electronic or mechanical brains, better safety engineering, and the development of management personnel. He feels that between 1965 and 1970 we will pass into the era of the three-car family.

Throw Them Away?

EVER SINCE the article (*AM*—May 7 '56, p154) on the new trend to throw things away, we have been receiving evidence that the string-saving streak in the American character is not dead. First we heard of people who regrind throwaway bits and use them again. Now comes word from Frank L Brugger that, whether you regrind or not, you should not throw them away. You should collect them and sell them to salvage organizations. At the present price of $1.35 a lb, the average throwaway bit is worth 8¢. Salvaged bits are broken up, sorted to required sieve sizes, and made into hard-facing electrodes.

Stability at Unprecedented Levels



HERE'S HOW BUSINESS WILL SPEND IN 1957

(Millions of dollars)

	1955	1956	1957 (planned)	% change 1956-1957
Petroleum	$ 4992	5618	6059	+14
Mining	318	423	461	+ 8
Railroads	923	1263	1364	+ 8
Other transport. & Communications	3403	4410	4922	+12
Electric, Gas utilities	4309	4817	6018	+25
Commercial	7349	7739	7992	+ 3
ALL MANUFACTURING	9440	12,647	14,434	+14
ALL BUSINESS	30,030	36,261	40,236	+11

HOW MANUFACTURERS WILL SPEND IN 1957

(Millions of dollars)

	1955	1956	1957 (planned)	% change 1956-1957
Iron and steel	$ 879	1257	1659	+32
Non-ferrous metals	293	589	937	+59
Machinery	809	1067	1169	+10
Elec. Machinery	436	606	709	+17
Automotive	1128	1719	1375	−20
Transportation Equipment	274	467	691	+48
Other metalworking	729	850	1013	+19
Chemicals	1016	1469	1895	+29
Paper	518	808	978	+21
Rubber	150	193	193	0
Stone, clay, glass	498	688	663	− 4
Petroleum refining	704	676	1014	+50
Food, beverages	718	798	848	+ 6
Textiles	366	451	414	− 8
Miscellaneous Mfg	922	1009	876	−13
ALL MANUFACTURING	9440	12,647	14,413	+14

NEW YORK—This is the biggest and longest capital spending boom on record, yet there's no downturn in sight, according to an all-industry survey of business's plans for capital spending in 1957 and 1958, just completed by the McGraw-Hill Economics Department. The survey's findings:

See 11% Spending Rise in '57

• **For 1957:** spending will increase 11% for an outlay of $40.2 billion on new plant and equipment for all business—1956's total outlay was about $36.3 billion, 1955's outlay ran about $30 billion.

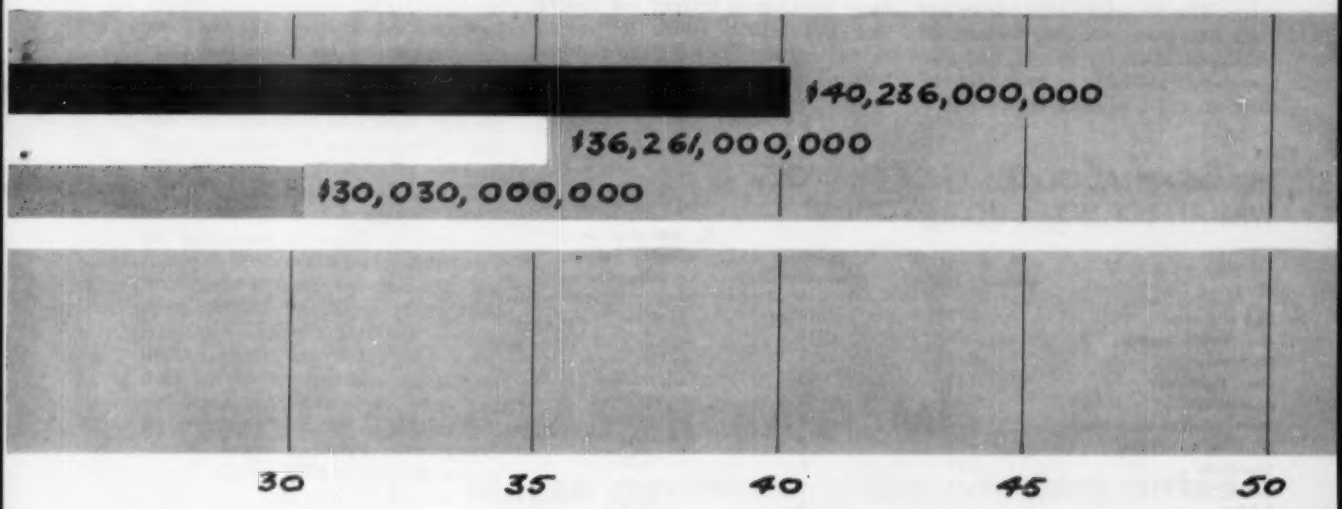
Of this total, manufacturers will spend $14.4 billion, 14% more than this year, but this represents a far smaller year-by-year increase than the 34% 1956 chalked up over 1955. Commercial enterprises, the oil industry, mining and railroads, too, plan smaller increases in capital goods spending percentagewise than they did in 1956. On the other hand, utilities will increase spending by 25%.

Another Rise in 1958

• **For 1958:** some two-thirds of the companies surveyed in all industries plan to maintain or increase spending from 1957 levels—only 30% ex-

NEWS REPORT

Keynotes Capital Spending Outlook



pect to cut their capital goods outlay.

• But the manufacturing industries apparently will cut back somewhat from 1957 spending levels. Last fall, 74% of the surveyed firms expected to either increase or maintain their spending levels in 1957, and 26% planned cutbacks: today, 32% plan smaller budgets. But, again, the utilities will help offset the decline strongly.

Prices Will Go Up 6%

• Prices for new plant and equipment will be about 6% higher in 1957 than in 1956, causing the increase in physical plant and equipment to be installed next year to be in the neighborhood of 5%.

Holdover Spending from '56

• Some 1957 expenditures will be holdovers from 1956, because of delays in construction. And in some industries, a part of 1957 spending will be rescheduled to 1958. Too, cash shortages—a result of lower profits and tightening credit—have had their effects, mainly in stretching out plans for expenditures, not in cancellations.

No Suez Effects Yet

• **Neither the elections** nor the Suez crisis have had any significant effect on capital spending plans to date—only 3% of the surveyed companies changed plans in any way because of the elections. But it is entirely possible that some firms may revise their capital spending thinking because of the uneasy foreign situation. However, the spending goals for 1957 reported in the current survey are only 6% or so higher than the early 1957 plans reported last spring. This is about the amount of spending originally planned for 1956 that deferred. Thus the increase over early estimates evidently represents a carryover from '56, rather than a new surge of spending plans.

In most manufacturing lines, companies plan to spend more next year than they did this year, with the largest increases slated for steel and non-ferrous metals, chemicals and petroleum refining.

Autos Will Decline

But there are declines expected, too—in automotive industry spending, and for residential building materials firms, and for the textile, furniture and other industries where demand has been slack in 1956. The big drop in automotive spending also reflects the absence of a major model change in most lines, after large sums were spent on capital goods for that very purpose in 1956. Lower profits and credit difficulties held back spending in textiles and miscellaneous manufacturing.

High '58 Budgets Set

Nevertheless, many manufacturing companies are already scheduling higher spending for 1958, particularly in the steel, machinery and electrical machinery, chemical and rubber industries. And by that time,

(Continued on next page)

CHANGES IN PLANS FOR CAPITAL SPENDING 1956-1957

	% change
Farm machinery	+60
Construction, mining machinery	+26
Engines, turbines	+77
Gen'l machinery	−13
Metalworking machinery	−13
Office machinery	+25
Special machinery	−31
Appliances (TV, radio)	+ 9
Aircraft	+56
Railroad equipment	+50
Heating apparatus	+11
Instruments, controls	− 8
Drugs	+21
Canning	+22
Airlines	+17

NEWS REPORT

CAPITAL GOODS (continued)

the auto industry expects to have leveled out its spending, so do petroleum refining and non-ferrous metal producing.

Railroads are stretching out their construction and equipment programs. The industry's 1956 outlay has been less than planned, because of freight-car delivery delays, and also because of difficulty in financing expansion, and a squeeze on profits.

Thus for 1957 railroads plan to increase total capital spending by only 8%—hardly more than the expected increase in costs for such equipment—and considerably less than might be expected from the huge backlog of freight car orders. But $1.4 billion seems to be the current outlay limit for the railroad industry unless earnings pick up or credit eases.

HOW CAPITAL GOODS PRICE CHANGES WILL AFFECT 1957 OUTLAY VOLUME

	% change in spending 1956-57	% expected price increase 1956-57	% indicated change physical volume of expenditures
Iron and steel	+32	8%	+22%
Non-ferrous metals	+59	10	+45
Machinery	+10	7	+ 2
Elec. Machinery	+17	8	+ 8
Automotive	−20	6	−25
Transportation Equipment	+48	7	+38
Other metalworking	+19	7	+11
Chemicals	+29	6	+22
Paper	+21	7	+13
Rubber	0	6	− 6
Stone, clay, glass	− 4	7	−10
Food and beverages	+ 6	8	− 2
Textiles	− 8	7	−14
Miscellaneous Mfg	−13	7	−19
ALL MANUFACTURING	+14	7	+ 7
Petroleum	+ 8	6	+ 2
Railroads	+ 8	7	+ 1
Other transportation & communications	+12	4	+ 7
Electric utilities	+25	7	+17
Commercial	+ 3	6	− 3
ALL BUSINESS	+11	6	+ 5

. . . AND WHAT ABOUT SPENDING IN 1958?

Here is what queried firms expect to do compared to 1957

	Will spend more	Will spend less	Will spend the same
Iron and steel	32%	42%	26%
Non-ferrous metals	14	50	36
Machinery	27	30	43
Electrical machinery	29	29	42
Automotive	14	21	65
ransportation equipment (including aircraft)	19	34	47
Other metalworking	19	31	50
Chemicals	26	37	37
Paper	29	46	25
Stone, clay, glass	17	40	43
Food, beverages	18	30	52
Textiles	15	34	51
Miscellaneous manufacturing	17	28	55
ALL MANUFACTURING	22	32	46
Mining	19	29	52
Petroleum	17	17	66
Railroads	8	13	79
Other transportation and communications	39	29	32
Electrical utilities	33	33	34
Commercial	29	26	45
ALL BUSINESS	24	30	46

Defense Machine Directory Now Out

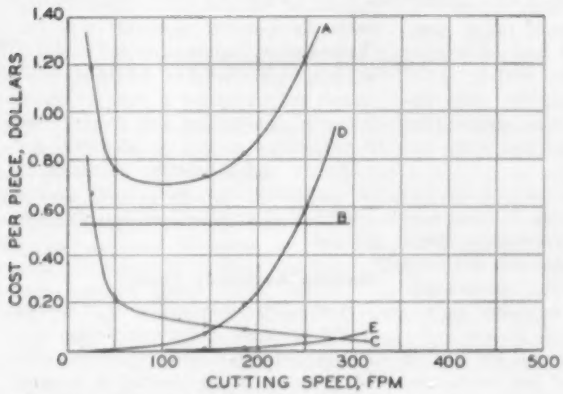
WASHINGTON—The 1956 edition of the Defense Dept's Directory of Metalworking Machinery is now on sale. Listing all machine tool manufacturers whose items are used by the Department, or those manufacturers who have new products for Department use, the Directory for the first time lists each machine under a Production Equipment Code Number (formerly known as the Standard Commodity Code).

The Directory is designed to aid the Defense Dept in managing its vast inventory of machine tools and the Production Equipment Code Number is especially adaptable to electric accounting machine tabulations for collection, transmission, correlation and review of machine tool data. It is available from the Superintendent of Documents, U S Government Printing Office, Washington 25, D C, at $6.25 a copy.

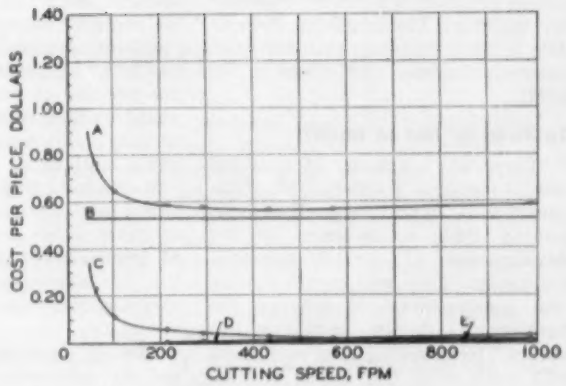
What Do Auto Owners Want?

DETROIT—When it comes to optional equipment on 1957 automobiles, just what do the owners themselves want? Dodge Division of Chrysler Corp has just completed a three-year survey of the question, and here are the answers:

- Better than 95% of those questioned want automatic transmissions. That compares with 91% in 1956, 87% in 1955.
- Full-time power steering is a must on one-third of all 1957 Dodges in showrooms today—a sharp increase over 1955's 23% demand.
- Requests for power brakes are up in the neighborhood of 8%.
- Better than 60% of 1957 Dodge buyers are currently ordering radios: only 48% did so in 1955. Even the swanky dual rear antenna is demanded by 30% of the buyers, versus a 19% demand in 1956.
- One of the biggest increases recorded on this year's models is a preference for outside left-hand mirrors—90% of all Dodge buyers want them now, as opposed to around 35% in 1955.
- Demand for windshield washers is on the increase. In fact some states, Michigan for one, require them by state law. Back-up light sales are picking up, too.



Comparative costs of carbides . . .
. . . in rough turning a cast-iron drive pulley with 10-in. dia. Irregular surfaces on the pulley required interrupted cuts. Curve A is total cost; B, load and idle cost; C, cutting cost; D, tool cost; and E, tool-changing cost. This high-



. . . and ceramics
strength iron has poor machinability with high abrasive wear on tools. Optimum cost with carbide tool is at 100 sfpm, with the ceramic tool is at 500 sfpm.

THREE TOP IDEAS FROM ASME:

1. . . Maybe ceramics are cheaper than carbides

NEW YORK—Results of a series of laboratory and shop tests that point to cases in which ceramic tools can be used more cheaply than carbides were reported at the annual meeting of the American Society of Mechanical Engineers held here Nov 25 to 30 (also see *AM*—Dec 3 '56, p113).

The tests, made jointly by Kearney & Trecker Corp and Marquette University, were reported by A O Schmidt, I Ham, W L Phillips, and G F Wilson.

Troubleshooting with Ceramics

After initial test work, the procedure was to apply ceramics to production jobs in which extremely rapid or excessive tool wear is encountered with carbides. The savings that resulted from one such application are shown in the charts at the top of this page.

The Top Cost Factors

A major factor in the cost saving was that the poor machinability of the work limited the carbide tool to a feed of 0.011 ipr, while the ceramic tool could be used at 0.016 ipr.

The major cost factor in ceramic cutting becomes the load-and-idle time, which may amount to as much as 90% of the production cost. Even greater emphasis must be put on improved handling if ceramic tools are to be used effectively.

Milling with Ceramics

After success was obtained in lathe operations, tests were made with a two-blade 6-in.-dia face mill. Ceramics that had performed well in turning were a failure in milling ferrous metals. Success was obtained on plastics and light alloys and with light finishing cuts on ferrous metals where the impact was reduced.

An important problem in application of ceramics is to provide adequate protection of the cutting edge against work-hardened chips which strike the cutting edge outside the region of cutting. The condition leads to major chipping and to tool breakage. The solution to this problem is a proper side-cutting-edge angle and chipbreaker shaped so as not to permit the chip to impinge on a part of the cutting edge that is not actually cutting.

Which Do You Use When ?

When a carbide tool is wearing too rapidly on the flank or by cratering, substitution of a harder grade of carbide may be the best solution. If this harder carbide still wears at a high rate, then ceramic tools should be tried if setup is rigid and power is sufficient.

2. . . Automatic assembly is primarily a question of economics, not mechanics

NEW YORK—The greatest problems in the development of automatic assembly are economic rather than mechanical, according to G R Fitzgerald, director, Process Development Section of General Motors. Speaking at the annual meeting of ASME here, he said that if the economics of an assembly situation are favorable, the mechanical problems involved can usually be solved.

Defining the role of the Process Development Section, Mr Fitzgerald said, "Its relationship with the General Motors operating divisions is similar to that of an independent research group or special-machine supplier."

Established 10 years ago, the section now employs 400 people. Contrary to a popular impression, the section has not specialized in auto-

ALL BUSINESS	24	30	46

picking up, too.

matic assembly. However, it has designed and built a number of assembly machines. The largest of these to date is the Oldsmobile cylinder-head assembly machine (*AM*—Sept 10 '56, p129).

To Build or Not to Build?

"There are a number of qualified special-machine builders," Mr Fitzgerald said, "who have well demonstrated their competence in the development of special assembly equipment. They will accept readily the responsibility of solving the equipment - design problems involved." Responsibility for economics still rests with the buyer and he must be sure of getting the greatest economic gain with the least added investment.

First step is an accurate study of costs of the existing method. Next step is to determine how existing facilities can be used to maximum efficiency. With this data assembled, the engineer explores as many combinations of manual and automatic assembly as possible. Never make the mistake of comparing only existing methods with total automation or only total automation with existing methods.

Most production situations cannot afford total automation. In most cases, there exists a tremendous range of improvement potential between the two extremes that almost any manufacturer can explore to advantage.

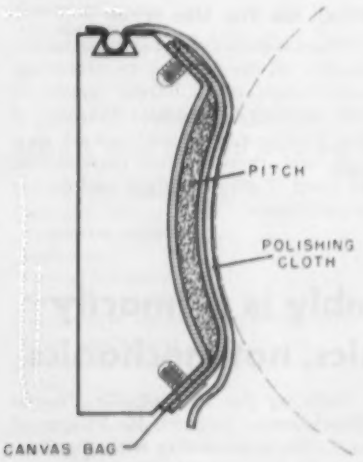
- Manual assembly allows sorting out by operators of an occasional bar end, mixed part, or miscut, but an automatic assembly machine can be jammed by such items. The addition of manual or mechanical sorting operations may add substantially to the cost.
- The allocation of indirect expense cannot be on the same direct-labor basis for manual assembly and for the proposed automatic equipment.
- Large and complex assembly machines may require a year or more between conception and production. Ample time must be allowed for complete and thorough "debugging" in both supplier's and user's plants before full production can be expected.

Cutting Assembly Costs

Assembly is one of the most fertile fields for cost reduction today, Mr. Fitzgerald concluded. However, rate of increase in equipment is usually greater than the cost reduction as the ultimate in mechanization is reached. Each part of the assembly operation should be equally self-supporting from an economic standpoint.

3 . . . "Ultrafinishing," conventional lapping with new twists, laps rolls to 0.5 microinches

NEW YORK—A number of innovations in the conventional lapping process make possible the production of exceptionally smooth metal surfaces with precise geometrical control. Developed for the production of rolls for photographic film, plastic sheeting, and metal foil, the process yields finishes of 0.3 to 0.5 mu in. rms.



PITCH-BACKED FABRIC LAP has a ½-in. pitch block in a canvas bag as backing for the fabric. When the lap is loaded, the pitch gradually takes the wheel curvature, but does not move fast enough to polish depressed areas

Developed by T G Lewis, Jr, research engineer, Mechanical Development Laboratory, E I du Pont de Nemours & Co, the patented process was described for the first time at the recent ASME annual meeting here.

Ultrafinishing, as the process is called, differs from conventional lapping in three ways:

- The lap is restrained about one or more axes with respect to the surface being finished.
- Control is exercised over the rate of change of shape of the lap by selection and combination of materials.
- Critical attention is paid to the abrasive-supporting surface of the lap at each stage of the process.

Low-velocity Ultrafinishing

In this form of the process, a cast cylindrical roll is electroplated with 0.040 in., of copper, ultrafinished, plated with 0.025 in. of nickel, and ultrafinished again. Velocity rarely exceeds 300 sfpm.

First lapping step is with 320-grit aluminum oxide and tool-steel laps at 60 R_c. This is followed by steps with 400- and 500-grit abrasive. The steel lap is then replaced with a pitch-backed lap (see drawing). In the fourth step, a pile-type wool fabric is used with levigated alumina. The final step is with a silk fabric and Linde polishing powder. Sperm oil is the vehicle through all steps and the lapping equipment provides a sinusoidal pattern.

Because of the large diameter of the rolls (15-ft dia is typical) the laps have an arc of contact of only 12.5°. It is necessary to restrain the lap so it cannot become skewed. Lap pressure can be applied by helical springs or pneumatic cylinders to give an even pressure of 3 to 10 psi.

High-velocity Ultrafinishing

For 440A stainless steel, X-alloy, Stellite, and other hard materials, a high-velocity process has been developed. The laps are made of lignum vitae (a tropical wood). The abrasive is diamond powder in olive oil. Lapping speed is about 9000 sfpm, proceeding in steps with progressively finer diamond powders.

For high-velocity lapping a cylindrical grinder was modified. Because of relative rotation of work and lap, cutting is at 45° on each side of vertical, providing a pattern breakup.

greater emphasis must be put on im- can usually be solved. section has not specialized in auto-

NEWS REPORT

"Automation Week" in New York Touches Off Intensive Hunt for Engineers

NEW YORK—Automation came in for some unprecedented publicity here the week of November 26-30, when the Power Show, the Third International Automation Exposition, and the Annual Meeting of the American Society of Mechanical Engineers opened their doors simultaneously for "Automation Week."

The three gatherings were the focal points of an intensive industry-wide recruiting drive for engineers. The "Help Wanted—Engineers" columns of New York dailies advised engineers to consult the columns every day during Automation Week, when firms from all over the country would be in town searching the job market for engineering talent.

50 Recruiting Teams

Following a practice by now fairly common on the West Coast, the Automation Exposition threw open the entire sixth floor of the New York Trade Show Building to teams of recruiters from some 50 top aircraft, electronic and instruments firms from all over the nation. In each of the suites, placards and literature advertised the respective companies' salary advantages, fringe benefits and the like, along with the joys of living in the company's vicinity, etc. Teams of recruiters were on hand to deliver the sales pitch, and if possible, to sign up a prospect right on the spot.

Recruiting Lorelei

One West Coast engineering firm went even this concerted effort one better. Its show booth was staffed by three pretty models, who handed out invitations to a cocktail party at the Statler. The first part of the week, the booth wasn't doing at all well, but when the models extended the invitations, business boomed and a stream of engineers poured into the suite.

The company, which has mushroomed from four employees less than two years ago to some 400 today, needed 40 engineers in a hurry, by Exhibition's end hoped to sign up at least half that many—no small feat in the intense competition of Automation Week.

What kind of engineers were in demand? According to company officials, the firm would hire "virtually anything in the way of engineers—electrical, design, mechanical, even not-too-senior project engineers." But one obstacle in the way of the West Coasters, who made up the majority of the recruiting firms, was in getting Easterners to move to an area which they still regard as something of an engineering frontier.

The Automation Exposition

Engineering recruiting was not, of course, the primary objective of the Automation Exposition. Four floors of the Trade Show Building provided 33,000 sq ft of floor space for more than 180 exhibitors of automation and instrumentation equipment and services.

Aside from the general open exhibit on the second floor, many exhibitors were housed in suites, which they chose to operate as classrooms and clinics for the more than 15,000 people expected to attend by week's end. Tape controlled machine tools, new computer developments and products were much in evidence, and were the center of attention. Among them:

● Automation for single-job and small-lot production can be worked out with Numill, a development of Autonetics Div of North American Aviation. This is a machine control that operates from a magnetic tape that is pre-recorded in conjunction with an IBM digital computer. A foot of tape will control an average operation, and up to about 200 operations can be recorded on a tape reel. Recorded information includes setup data that is flashed on a display panel to tell the operator which tools and fixtures are required for the job whose number he has dialed on the control. Unit provides permanent storage so any job can be repeated. Setups can be made on lathes, millers, or grinders, and control is accurate to 0.001 in. Leadscrews do not control spindle positioning. Mock setups at the exhibit showed how 2-D and 3-D jobs were run off, including one-knob control of mirror reversing to make matching left-right parts.

● Accurate locating is done by Inductosyne, made by Farrand Controls. These units are longitudinal or circular grid patterns or metal placed on glass plates. Spacing accuracy is to 0.0001 in. on the linear unit, and to one sec of arc on the circular one. The plates act as locating units in automation systems added to old machine tools, where operation is by pushbutton.

● Elements of automation can be added to existing machines to equip them for any degree of automation. Airborne Instruments' Microtrol line includes gaging units in standard sizes and types for checking machine output and controlling machine shutdown if parts are off size. Another size control is made by Electronic Control Systems to test, sort, analyze, and record results on production parts. The same company also builds a positioning unit for machine tables. This signals when the part is in the desired spot, which allows a machine head to operate. Control is called Digimatic, and operates from punched tape on the digital principle to 0.001-in. accuracy. Semi-automatic model allows direct keyboard punching, without tape control, to move table as desired.

Probograph rotary head controls

● Probograph controls for machine-tool rotary heads and tables use electrical signals, leadscrews, and air, electronic, and optical gages for automatic positioning. Drive systems are mechanical, however, and do not depend on air, electronics, or hydraulics. Units are built by Warner & Swasey Research Corp.

● Size control for throughfeed centerless grinders is provided by Kaydon Engineering's Size-O-Tron. This does automatic parts gaging and classifying, and signals a control on the wheelhead feedscrew to make size adjustments. Rough adjustments of the wheel can also be made through the controls for the setup.

● Another positioning system, by Hillyer Instrument Co, uses punched tape to control a machine table to within 0.001 in. The equipment is intended for modernizing old or hand-operated machines for automatic production, for which it will control table motion in two directions.

FIELD REPORT

enough to polish depressed areas with 400- and 500-grit abrasive. The vertical, providing a pattern breakup.

FIELD REPORT

East...

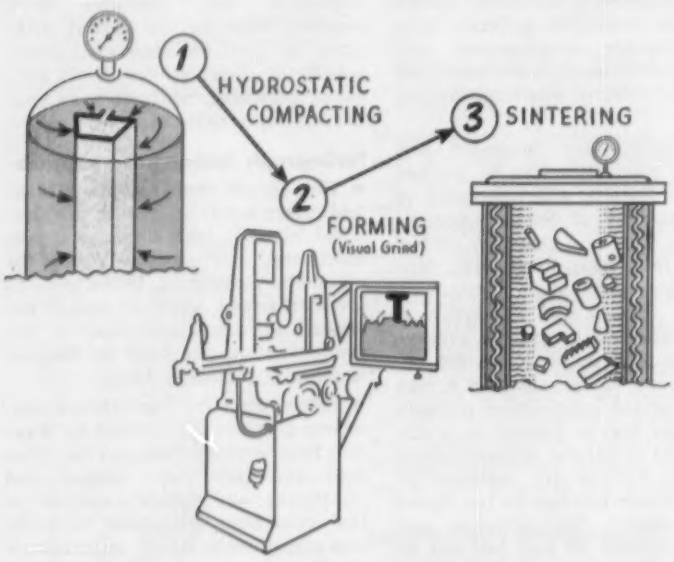
Eastern newsnotes . . .

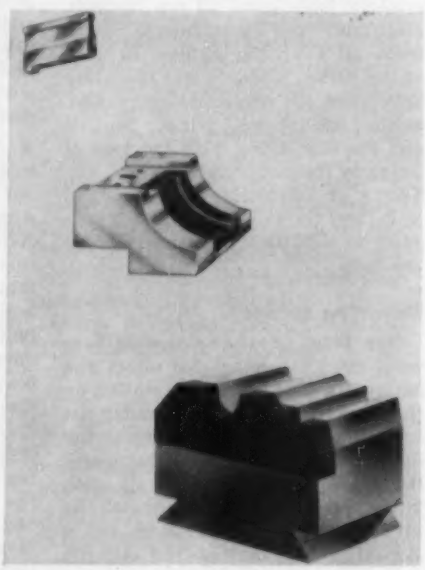
IBM's electric accounting and electronic data processing machines are now for sale as well as for rent. Policy change is result of consent judgment entered into last Jan between the company and Justice Dept to settle an anti-trust suit. Selling prices range from $1950 for a card punch (rent, $40 per month) to $1,700,000 for an electronic computer ($30,000 to rent) . . . **Fairchild Engine & Airplane Corp** is acquiring **Jonco Aircraft,** Shawnee, Okla, maker of tooling for aircraft manufacturers. Company, which Fairchild has been operating for the past year, will become a wholly owned subsidiary . . . **GE's** half-billion dollar expansion program may have to be increased by 100 or 200 millions, according to Philip D Reed, chairman. Since the three-year program was agreed upon in Sept, estimates of sales volume in all divisions have been revised upward . . . **Raytheon** reports contracts totaling $35 million to make military electronic equipment for Army Ordnance. Work is slated for the Shawsheen plant in Andover, Mass . . . **Bethlehem Shipbuilding** at Quincy, Mass, has a $2.5 million Navy contract for initial planning and design of first nuclear-powered cruiser equipped to fire guided missiles . . . **Titanium Metals Corp of America** has reduced prices 6 to 8% for titanium mill products; reduction is second this year, fifth since Feb '54 . . . Products of Penn Instruments Division of **Burgess-Manning Co,** Philadelphia, will in future be referred to as **Burgess-Manning Instruments** . . . America's steel industry will have to expand ingot production capacity by 50% in the next 15 years to keep abreast of general economic growth, says **Bethlehem Steel's** President A B Homer. One bug: cost per ton of adding needed capacity may treble in that period . . . **American Machine & Foundry,** New York, plans to consolidate its research and development activities in a $4-million center at Stamford, Conn . . . **Budd Co's** latest step in its diversification program is establishment of a subsidiary, the **Tatnall Measuring Systems Co.** It'll develop new systems that will automatically combine the elements of measurement for broad variety of industries and uses . . . **American Brake Shoe Co** will unite four of its railroad divisions in a newly created Railroad Products Division, effective Jan 1. Included will be railroad product facilities of Brake Shoe & Castings, National Bearing, Ramapo Ajax, and Southern Wheel Divs. And company is entering the specialty aluminum castings business; new foundry is being constructed at Mahwah, NJ . . . **Piasecki Aircraft,** Philadelphia, has acquired the 330-acre plant and machinery of **Bellanca Corp's Aircraft Division,** Wilmington, Del.

West...

Around the West . . .

General Dynamics' Convair Division plans to centralize receiving, shipping and warehousing for all its San Diego operations in one giant building. The 1-million-sq-ft warehouse and materials depot will cost $4.5 million; 200,000 sq ft of the structure will be ready for March occupancy . . . **IBM** has shifted manu-





Carbide Sintering Technique Turns Out Complex Form Tools

HYDROSTATIC PRESSING of tungsten carbide powder, a new technique developed by Sintercast Corp of America, Yonkers, N Y, produces cemented carbide contour tools of high dimensional accuracy in complex shapes. Main steps in the technique, as shown in photo at left, are (1) hydrostatic compacting, with equal pressure applied to the powder mixture from all directions, (2) forming, with exact shapes and precise dimensions achieved with optical grinding, and (3) sintering to full hardness with controlled vacuum treatment. With this method, Sintercast is able to provide form tools such as those shown here for turning, milling and shaping operations, and contoured carbide blanks for blanking, forming and drawing punches and dies

Automation Week.

What kind of engineers were in

● Accurate locating is done by In-

production, for which it will control table motion in two directions.

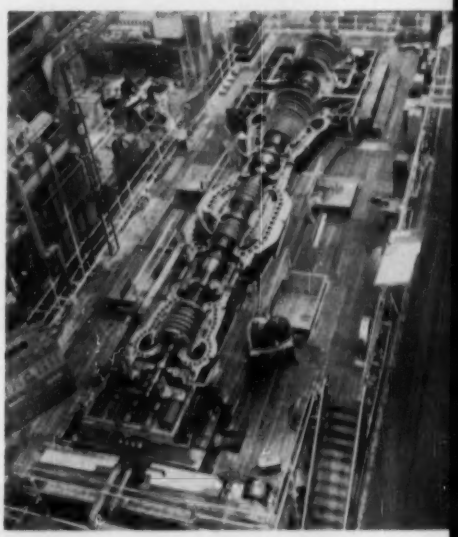
FIELD REPORT

facture of three calculators of the 600 series from Poughkeepsie, NY, to San Jose. Transfer will begin next month, full production is scheduled for July . . . **Fisher Body** assembly plant at Oakland, Calif, will get a 42,000-sq-ft addition to its present 304,000 sq ft of floor space; expansion will be completed by Sept . . . **Hughes Aircraft** has begun work on a $1,250,000 missile engineering facility at Tucson, Ariz. All production and sustaining engineering for the Falcon air-to-air guided missile will be transferred from Culver City, Calif. The 50,000-sq-ft facility, scheduled for Nov completion, will employ 500 . . . **Connor Spring Manufacturing Co,** San Francisco maker of mechanical springs and wire forms, is expanding its plant area 25% for an increase in production . . . **Varian Associates,** Palo Alto, Calif, electronics firm, reports sales for the year ended Sept 30 boomed 54% above the previous year. Microwave tubes accounted for 75% of the volume, instruments the remainder; backlog is well above $11 million . . . **Motorola, Inc,** has established a new Industrial Semi-Conductor & Military Electronics Division at Phoenix, Ariz . . . Good news for the steel-deficient West came from **Pacific States Steel Corp** which plans to install a 400-ton-per-day blast furnace at its Niles, Calif, steel mill; it'll be the first fully integrated steel mill in the San Francisco Bay area . . . **Consolidated Electrodynamics Corp** has purchased major assets of **R A Castell & Co,** Glendale electronic components manufacturer; it'll operate as the **Glendale Division** of CE . . . **Pacific Industries, Inc,** San Jose, has taken over management of **Tyler Mfg Co,** Hannibal, Mo, tool and die manufacturer. Tyler will produce heaters now being made by two PII subsidiaries, **San Carlos Mfg Co,** San Carlos, Calif, and **Heating Equipment Mfg Co,** San Francisco. Company will turn out 4000 units a month . . . **Solar Aircraft's** backlog as of Oct 31 was almost $92 million, a nice increase over the $53 million plus of the previous year. But sales of $34 million for the six-month period ending Oct 31 (up from $25 million) couldn't erase a $500,000 loss resulting from month-long strike plus engineering changes . . . **Link Belt** will build a new plant in Montebello, Calif, about 10 miles east of downtown Los Angeles to replace and expand its operations in LA. Unit which will more than double present manufacturing facilities will be completed by next Nov . . . Forty-five manufacturers of house trailers exhibited their wares Nov 28-Dec 2 at Mobile Homes Manufacturers Assn's first West Coast trade show. Association predicts the industry's gross sales will top $500 million this year, a 15% boost over last year's all-time high.

South . . .

Down South . . .

Glenn L Martin Co will begin construction of its 1-million-sq-ft plant near Orlando, Fla, in March; work will be completed in twelve months . . . **Lake Shore Industries,** Cleveland, Ohio, firm, will build a half-million dollar plant at Batesburg, S C, for production of jet and commercial gas turbine engines . . . **Lockheed Aircraft's** Georgia Division at Marietta is winding up B-47 production. Work force of 19,000 will be gradually reduced by about 1000 during next seven months; mass of workers will still be busy turning out the new C-130 AF transport plane and modifying B-47's . . . **Johns-Manville** has started manufacturing operations in



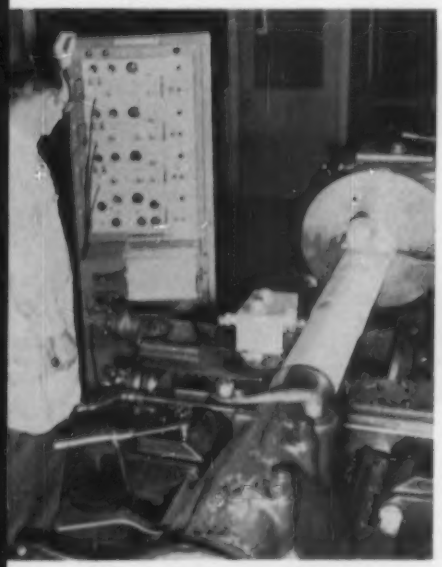
WORLD'S BIGGEST automatic extraction steam turbine (2.8-million lb of steam per hr) undergoes assembly for tests at General Electric in Schenectady. It's slated for Public Service Electric & Gas Co's Linden, N J, power plant, where its steam will first generate electric power, then be piped almost a mile to an oil refinery, where it will be re-used to process petroleum

Ride 'em welder!

This unusual travel carriage at the Groton, Conn, plant of General Dynamics' Electric Boat Division supports an automatic welding head for submerged arc welding joints between hull sections of the Navy's new atomic submarine "Skate." Carriage remains stationary at about top center of the hull, its rollers allowing the hull to rotate smoothly under it as the electrode point is guided squarely by the "jockey." Heavy hull plate requires a deep Vee-butt joint welded in three passes by the welding head—a Lincoln Electric LAF-2 model, with a 7/32-in. electrode wire carried on the spool. Time required to make the joint, about 100 hrs, is more than three times as fast as the old hand welding methods. Welding speeds on first, second and third passes, were respectively 9, 16 and 14 ipm. Four induction coils on each side of the joint preheated hull sections to 150 F. Here you can see the flux stream pouring over the arc and electrode point. Slag peels readily from the bead, leaving a bright, smooth surface for the succeeding deposit. All completed hull welds are x-rayed 100% for soundness (hull sections weigh 20 to 60 tons).

FIELD REPORT

Savannah, Ga, its 26th location. Plant will produce asphalt shingles and roll roofing . . . **Southwest Metal Finishing Co,** Tulsa, Okla, has purchased property in Jackson, Miss, will begin complete commercial plating service in Dec . . . **Milgo Electronics Corp,** Miami, has just finished its first year of operations with $1 million worth of research and development contracts in the works . . . **Babcock & Wilcox Co's** heavy boiler plant at Brunswick, Ga, is expanding its facilities, now has a night shift for the first time since 1954 . . . **Chevrolet Motor Division** has broken ground for its new 280,000-sq-ft major supply depot in Atlanta; project will be completed in Oct . . . **GE** has opened its new $100,000 service center and office building in Atlanta . . . **Gulf Oil Corp** has purchased options on 3000 acres of land near Charleston, SC, as possible future site of an oil refinery . . . **Mott Body Works,** new Americus, Ga, business, has just turned out its first refrigerated truck . . . **Standard-Southern Corp,** distributor of oil field and industrial pipe supplies and equipment, has a half-million-dollar expansion program in the works that'll provide a new warehouse, office building, and pipeyards in Beaumont, Tex . . . **James Steel & Tube Co,** Madison Heights, Mich, manufacturer of electric weld tubing and tubular products, is opening an additional factory facility on a 2-acre plot in the new Miami industrial district in North Dade. Company is second large northern manufacturer to move to the district during the past few months; **Fruehauf Trailer** is already in operation.

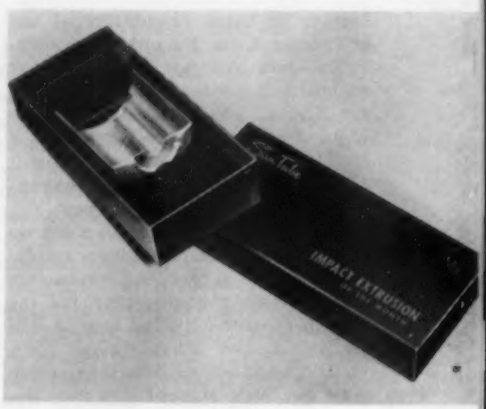


Testing carbides . . .

on a lathe for three components of force is done in GE's Metallurgical Products Department, Detroit, using this 4-channel electronic oscillograph as a measuring instrument. Machine not only measures strain, but analyzes speed, temperature, machine tool horsepower

Midwest...

Midwestern briefs . . .
Bohn Aluminum & Brass Corp is reportedly negotiating sale of its subsidiary, **Reo Motors, Inc. White Motor Co** of Cleveland is interested, but spokesmen of both companies aren't commenting for the record. Bohn acquired the Lansing, Mich, truck maker two years ago for an estimated $16.5 million; in the first nine months of this year Reo chalked up a net loss of $120,701 as against net profit of $549,623 for the same period last year . . . **Link-Belt Co,** Chicago, has acquired **Detroit Power Screwdriver Co** through exchange of stock. The Detroit company, with 95 employees, will be operated as a subsidiary by its present management . . . **Ford Division** of **Ford Motor** last month reached an all-time high of 8542 trucks and cars turned out in a single day. Division, which has upped production capacity 20% in the last 18 months, has broken ground for another assembly plant in Lorain, Ohio . . . Stockholders of **Bingham-Herbrand Corp,** manufacturer of metal stampings and drop forgings, and of **Van Norman Industries** have both approved merger. B-H management will continue operation in Toledo and Fremont through a newly formed subsidiary of Van Norman . . . First of the 260 presses ordered for **Chrysler Corp's** new stamping plant has been installed at Twinsburg, Ohio. Eight of the 28 major press lines are expected to be operating with partial production by the scheduled February opening date . . . Possibility is looking more like a probability that **GM** will put up a stamping plant adjacent to the proposed Chevrolet and Fisher body assembly plants at Lordstown, Ohio . . . **Flexonics Corp,** Maywood, Ill, has acquired the **Flex-O-Tube Division** of **Meridan Corp,** Inkster, Mich; operations will continue as a Flexonics division . . .



"Impact Extrusion of the Month"

. . . that's the novel promotion dreamed up by Sun Tube Corp, Hillside, N J. Each month, a similar extrusion will be sent to 550 potential customers to demonstrate the versatility of the impact extrusion process. This one is a complex, double-walled ordnance component, cut in half to show its characteristics. The aluminum piece is 3.375 in. long by 2.74 in. dia, with an internal tube 0.650 in. dia: it requires only end trimming, was produced complete with one stroke of the impact extrusion press in 1/20 of a second

General Electric has increased prices 5 to 10% on several of its product lines because of rising costs of labor and materials. Standard and special Carboloy carbide blanks are up 5%; Carboloy mechanical toolholders and diamond wheel dressers, 10% . . . **Ex-Cell-O** of Canada is three years old this month. Plant size has tripled; worker force has jumped from 80 to 400 . . . **Federated Metals Division** of **American Smelting & Refining** will put up a large secondary aluminum smelter at Alton, Ill, in 1957. It'll have an annual capacity of 72 million pounds of aluminum alloy ingot, double present production . . . **Ford Motor** says overtime is now up to 35% above normal in most plants, will be further increased this month . . . **Youngstown Sheet & Tube** will consolidate its **Continental Supply Co** and **Emsco Manufacturing Co** divisions into one division to be known as **Continental-Emsco Co;** general offices will be in Texas . . . **Warner Automotive Parts Division** of **Borg-Warner** will be housed in a new 162,000-sq-ft facility at Auburn, Ind; construction will be started in the spring.

Clayton Burt, president and chairman of Niles-Bement-Pond Co and a past president of the National Machine Tool Builders' Association, holds silver bowl presented to him by officers of NMTBA in recognition of his meritorious service to the machine tool industry.

John Elliott has been appointed technical advisor (machine tools) in the Ministry of Commerce and Heavy Industry, Government of India, for a three-year period. He will be located in New Delhi, India. He was Washington representative of the Cross Co in 1954 and 1955.

Clayton DuBosque, Jr, engineering assistant to the general products group executive of American Machine & Foundry Co, has been appointed assistant to the executive vice president of the company

Names in the News . . .

Frank F Elliott has been named chairman of the board of Crane Co. He will be succeeded as president by **Neele E Stearns,** vice president for planning and development of Inland Steel Co. Both men will assume their new duties Jan 1.

Norman R Amberg, plant superintendent of Yale Materials Handling Division, Yale & Towne Manufacturing Co, has been promoted to works manager.

Stuart H Smith, general sales manager of SKF Industries, has been elected vice president, sales.

Robert W Pearson, formerly manager of reliability control in the missile and surface radar department of RCA, Moorestown, NJ, has been appointed to the new post of deputy general manager for operations at American Machine & Foundry Co's Electronics Division, Boston.

Sidney L Eastman, chief engineer of Cleveland Worm & Gear Co, has been appointed vice president, engineering. **Lee O Witzenburg,** general sales manager of the company and its affiliate, Farval Corp, has been named vice president, sales, for both firms.

John R Dingle, process engineer for Cleveland Worm & Gear Corp, and its affiliate, Farval Corp, has been appointed vice president, manufacturing, for both firms. (Additional appointments listed left)

Edward H Perkins, Jr, has been elected vice president of Brooks & Perkins, Inc, Detroit fabricator of magnesium and titanium. Mr Perkins has been manager of the company's Magplate Division, and administrative assistant to the executive vice president.

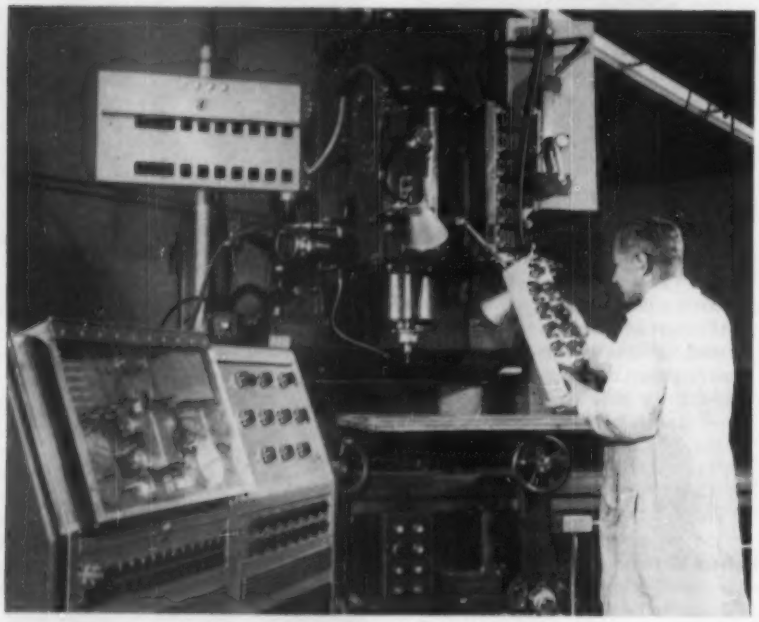
Robert B Manning, vice president of Sperry Western, Inc, has been elected president. He will continue to serve as assistant to the president and products manager of Sperry Products, Danbury, Conn, parent company

Thomas W Johnson has been named vice president of New York Air Brake Co. He will continue in his capacity as group executive in charge of the Vacuum Equipment and the Kinney Manufacturing Divisions

Obituary

Neal Willis Foster, 72, vice president and general manager of Newton & Thompson Co, Brandon, Vt, died Nov 13. Before joining the company in 1938 Mr Foster was executive vice president of Boston Gear Co, Quincy, Mass; prior to that he served as executive vice president of National Acme Manufacturing Co, Cleveland. He held the post of deputy administrator in charge of heavy goods for the NRA, serving under Hugh Johnson and Averell Harriman.

New Shop Equipment,



TAPE CONTROL SYSTEM, shown with a Cincinnati Hydro-Tel miller, is set up to control a templet-milling operation. Above tape reader and console on left can be seen display panel, which tells operator what material and tools to use

Automatic Machine-Tool Control Speeds Small-Lot Production

The advantages of automatic machining, usually limited to production operations, have been extended to small-lot and single-part production of aircraft tools and parts at North American Aviation, Inc, with the installation of Numill, a tape-control system for standard machine tools. Numill controls were developed by Autonetics Div of North American to produce templets, profile bars, profile mill fixtures, and other two-dimensionally defined parts required in aircraft manufacturing.

Guided solely by instructions recorded by a standard electronic brain on magnetic tape and continuously monitored by automatic electronic gages, finished tools or parts are made without the use of blueprints. System can be used on such machines as lathes, boring mills, contouring mills, and grinders.

Controls consist of a display panel, control pendant, measuring gages, and a tape-reader console. Display panel is used to inform operator of necessary set-up information, such as the size and type of material and cutters to use, and machine speeds; this data is received from a magnetic tape, and is indicated on the panel as edge-lighted words and numbers, in an appropriate sequence during the machining cycle.

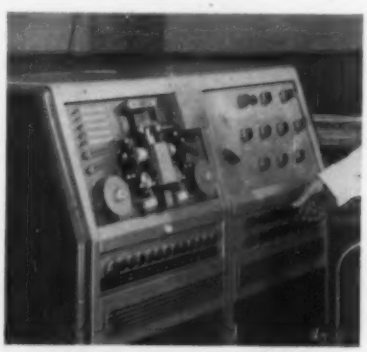
Measuring gages—one along the back of machine table, the other along the traversing slide of machine column—are used to measure the amount and direction of machine movements; their operation is based on the use of inference patterns generated from optical gratings. Gages provide an accuracy of better than 0.001 in. over 8 ft at 65 F.

Tape-reader console reads digital information from the control tapes, and translates these numbers into pulse-trains of appropriate frequency and length, actuating and controlling machine-tool movements in accord with tape instructions. Console, which measures 45 x 49 x 21 in., is fully transistorized and uses no tubes.

Present Numill controls are applied to a standard 28 x 96-in. Cincinnati vertical Hydro-Tel milling machine. Point and path control are provided over full length of the two horizontal axes of motion, enabling the machine to combine milling and drilling operations with a maximum of speed and flexibility. The head may be positioned vertically in a series of steps or elevations. Movements are not subject to leadscrew inaccuracies or backlash, as from mechanical controls.

Tapes used in the system are made in conjunction with an IBM 700 Series digital computer. Input data consists of basic tool or part dimensions, sequence and type of operations, machine spindle speeds and cutter sizes, and type and size of material. Computer translates this basic data into the series of commands required to produce the part; it calculates path which cutter must follow to generate the contours specified, also calculates machine accelerations so that cutter may negotiate corners or change direction without such errors as over-shoot. These calculations are written onto magnetic tape as numbers, in binary code. The Numill control system then translates data from the magnetic tapes into machine movements.

Autonetics Div, North American Aviation, Inc., International Airport, Los Angeles 45, Calif



TAPE-READER CONSOLE searches and finds portion of the magnetic tape that contains information to produce a desired tool or part. Tape can contain as many as 200 individual-part instructions; operator simply dials for a particular part

Materials and Parts . . .

Power-Assist Mechanism Feeds Cutter on Sundstrand Router

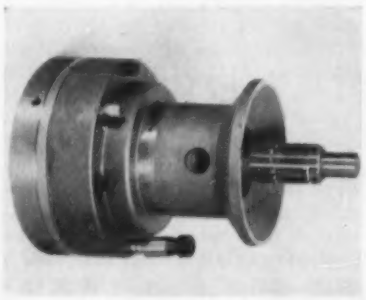
Rigidmil Router does not depend on the operator's strength to obtain maximum efficiency; instead, a power-assist mechanism supplies the force required to feed the cutter through the work. Sizable work capacity is provided by a 4-speed vertical spindle head rated at 15 hp at 7200 rpm.

Power is offered for all three basic movements used in the machine: longitudinal movement of the gantry and transverse movement of the saddle are controlled by the operator through the power-assist mechanism; depth movement is controlled by a pushbutton unit, with downward movement limited by a 6-station, manually indexed turret stop on the saddle; spindle speed changes are by means of pushbuttons located on the power-assist handles. The rigidly braced gantry is arranged on an angle for an unobstructed view of both follower and cutter.

The stationary table is 19 ft long and 5½ ft wide, with the spindle center covering a rectangular area over the table, 12 ft long and 5 ft wide. Feed and rapid traverse rates are both determined by the amount of manual pressure exerted on the power-assist handles by the operator.

Conventional routing feel and control is not lost by the use of the power-assist mechanism. Either offset routing or overlay templet work can be done with the machine.

Sundstrand Machine Tool Co, Rockford, Ill



SPLINE AND GEAR CHUCKS in Multi-Plex line will centralize work accurately on the pitch diameter with adjustable teeth and lock tightly in two or more parts with internal teeth, even though the variation in tooth space width between both parts exceeds normal tolerances. Two or more splines or gears can be chucked at one time. Spline chuck (illustrated) features locking action by springs; parts are released by forcing air into a cylinder, compressing the springs—*MP Tool & Engineering Co, PO Box 316, Van Dyke, Mich*

...including

MACHINE TOOLS AND ATTACHMENTS

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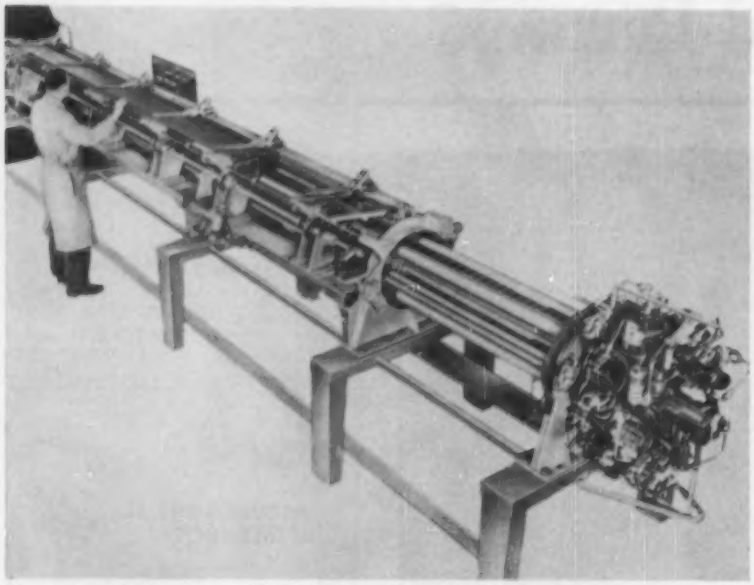
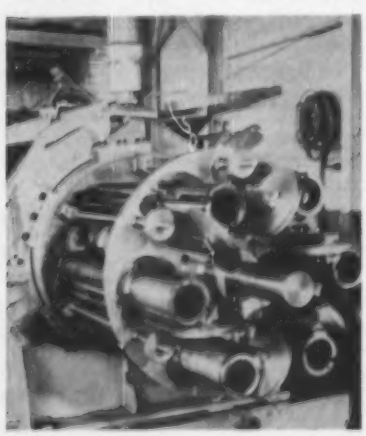


MULTI-SPINDLE BAR FEED, shown with covers removed to display operating parts, indexes to 6 spindle positions on a bar automatic (4- and 8-spindle versions are also available). At right is the principal air mechanism, including one air-operated motor for each of six split stock-tubes. Each motor powers its stock pusher within each tube

Lipe-Rollway Automatic Loader Boosts Bar-Automatic Production

Designed to reduce the time lost due to the manual or semi-automatic loading of stock on multi-spindle bar automatics, a multiple-spindle bar feed has been developed that automatically indexes to as many as eight fixed-stop positions on bar automatics, holds several hours' supply of stock, ejects remnants, and reloads automatically. Feed is reported to have performed at 96% gross production capacity, compared to an average of 70% efficiency to be expected with conventional feeds.



SPINDLE REEL on bar feed revolves with spindle head of bar automatic. When split stock tube is in position to accept a new bar, pins at magazine base retract, permitting one bar to drop into stock tube

Feed consists essentially of a magazine on which stock is racked diagonally; a reel containing 4, 6, or 8 split stock-tubes or spindles; air-operated motors, one to a spindle; a stock pusher (moved by air motor) within each tube which moves stock against collet jaws to a fixed stop position on the bar automatic, engaging the machine clutch; an air-operated braking mechanism that halts the spindle-reel revolution when it reaches its proper index position; a hydraulic check unit, controlling feed-out of stock against the stock-stop at a constant rate; and a safety shut-off device to stop both bar feed and machine in the event of jamming.

Stock sizes which the bar feed can accommodate are 2 in. max and ¼ in. min.

Lipe-Rollway Corp, Syracuse, NY

Kaydon Gage-and-Feed System Controls Centerless Grinders

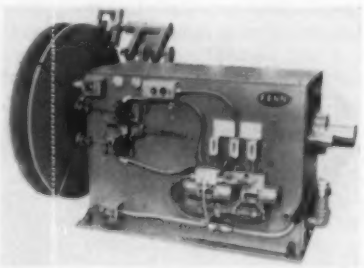
An automatic mechanism called Size-O-Tron has been developed to control through-feed centerless grinders. System utilizes feed-back principle to gage automatically parts being ground, adjust the grinder to compensate for wheel wear, and record size. Finished work is continuously gaged as it emerges from the machine, and the information from the gaging unit is fed back to the machine, automatically adjusting for wheel wear and all other variables that affect size changes.

Mechanism consists basically of a gage-control unit and a machine-adjusting control unit. Gage-control equipment consists of a pickup unit of the electronic differential-transformer type located at work outlet of machine. Also included is a classifier unit and calibrated meter capable of receiving and amplifying the gage signal in seven electronic classified categories.

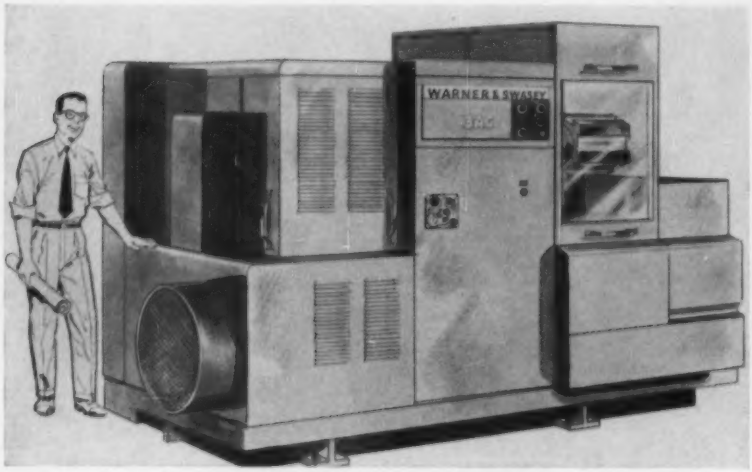
Machine-adjusting control equipment consists of a rapid-traverse gear motor, feed-rate gear motor, and pulsating actuator; all are integrated with and actuated by the gage-control unit.

Should the parts being ground deviate more than 10 millionths of an inch from the desired size, the electronic controls detect the trend and start to correct the situation. If some extraordinary condition beyond the control's ability to correct should arise, the controls stop the grinder immediately. In operation, control attached to a centerless grinder is said to be capable of maintaining a tolerance of 0.000050 in., disregarding the inherent inaccuracies of the machine. A recorder prints a continuous story of the size maintained. Package unit is offered for installation on grinders.

Kaydon Engineering Corp., McCracken St, Muskegon, Mich



TRAVERSE TAKE-UP REEL, Model 2310, is used in combination with Fenn wire-flattening mill. Unit is floor mounted, has 3-in.-dia spindle and 10-in. stroke. Max weight of stock which can be coiled on reel is 2000 lb, and max permissible stock tension is 300 lb. A 36-in.-OD drum can be mounted on spindle. Reel is available in both larger and smaller sizes—*Fenn Mfg Co, Fenn Rd, Newington, Conn*



Single-Spindle Chucking Automatic Is Added to Warner & Swasey Line

Suited for short as well as long production runs of large-size precision work, Model 3AC is an addition to company's line of single-spindle automatics. During the machine cycle, unit provides automatic regulation of spindle speeds, feed changes, cutting-stroke length, turret indexing, and both front and rear cross-slide operation. Operator has only to load work, press cycle start button, and then unload finished work when machining is completed.

Quick setup of the machine is obtained through a simple placement of switch-operating screws in the index control drum which regulates the various machine functions, and by setting easily adjusted trips on the machine's pentagonal control drum for feed rates, spindle speeds, and cutting-stroke lengths. Overhead turret is offset from spindle centerline to facilitate loading work. Turret and spindle bearings are mounted in the same housing, so that cutting tools need not be constantly adjusted to compensate for changes caused by temperature effects.

Both the front and rear slides can be set to operate together or individually with any overhead turret face, and three cross-slide functions —normal, early, and late—are applicable to either or both units. For greater cutting-tool efficiency during a late cross-slide cut, two automatic speed and two feed changes are available. Cross-slide units also can be used to actuate turret slide tools for such operations as internal facing, internal recessing, and back facing.

Any six spindle speeds—from a high range of 65 to 826 rpm or a low range of 30 to 385 rpm—may be selected and obtained automatically during the machining cycle. A range of 36 feeds, from 0.0019 through 0.124 in., is available; any six of these feeds can be selected by inserting proper change gears and adjusting trips on control drum. Change gears also can be furnished to lead in taps or dieheads used in cutting right-hand threads from 7 to 32 threads per in.

Machine swings 13½ in. over the cross-slide and offers a maximum turret working stroke of 11 in. Spindle has an 11-in. Type A-2 American Standard flanged nose, and is equipped with an air-operated 15-in. chuck. Standard drive motor is a 40-hp non-reversing type; two-speed motors and reversing motors are also available for special requirements.

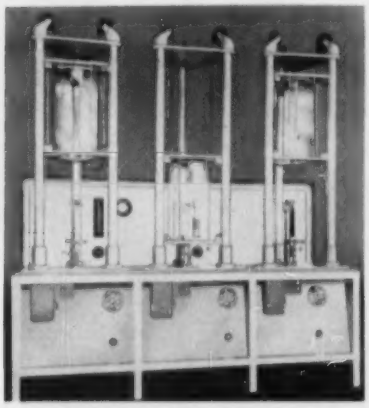
Warner & Swasey Co, 5701 Carnegie Ave, Cleveland 3, Ohio

Chemtrol Plastic Valves Work At High Pressures, Temperatures

Series of general-purpose rigid polyvinyl-chloride valves is designed to operate under conditions generally considered beyond the capabilities of ordinary plastic materials. Valves operate up to 170 psi, continuous duty, and in lower pressure systems may be used safely at temperatures up to 170 F (or higher for intermittent duty).

Valves are said to have excellent corrosion resistance, constant-flow characteristics, and immunity to electrolysis and galvanic action. They are available in ⅛- and ¼-in. pipe sizes and ⅛-, ¼-, and ⅜-in.-OD male tube connections.

Chemtrol Corp, 11003 Santa Fe Ave, Lynwood, Calif



Lepel Heating Fixtures Braze Metal Without Using Flux

Production fixture has been developed to braze metal assemblies without the use of flux by induction heating under a controlled atmosphere. Joints produced with unit are said to be uniformly sound and free of residual or entrapped flux. Unit reportedly has joined copper alloys, steel, and stainless steel on a production basis.

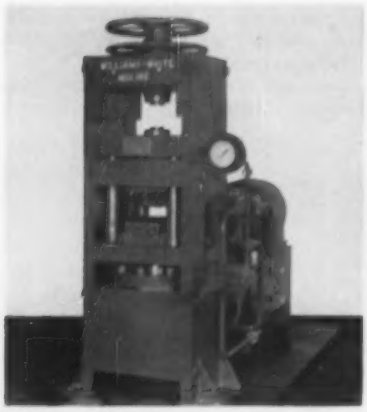
The three work stations are operated from a single induction heating unit. High-frequency current is fed to work coils through coaxial leads, and proper atmosphere is obtained by directing a continuous flow of purified gas into the glass or Plexiglas bell. Flow of gas is controlled by flow meters at each station, which allow gas to enter through the top, spread through a diffusion plate, and escape through the bottom. Glass bells are counterweighted to move freely on posts, so that work handling is facilitated.

In the illustration, bell on the left is in a loading position and bell on the right in a heating position. Heating cycle is automatically controlled at each station by pre-set timers, enabling one operator to work all three stations.

Lepel High Frequencies Laboratories, Inc, 55th St & 37th Ave, Woodside, NY

CORRECTION—Name and address of the manufacturer of the releasing-type tapholder described in a recent issue (AM—Dec 3 '56, p196) was inadvertently omitted. Maker of the device, which is designed for multiple-spindle screw-machine operations, is the Marcellus Mfg Co, Belvidere, Ill.

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



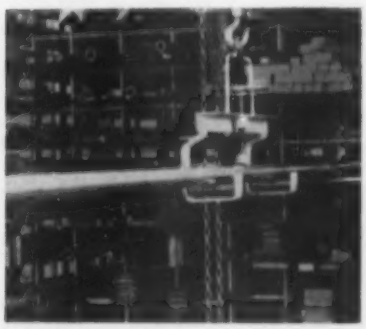
Williams-White Hydraulic Press Shears and Upsets Wire Samples

Designed and built primarily for the steel industry, 100-ton hydraulic press is used to shear and upset samples of wire for quality and/or upsetting characteristics. Control of the moving platen, which actuates both the shearing and upsetting attachments, is through a knee-operated 4-way valve.

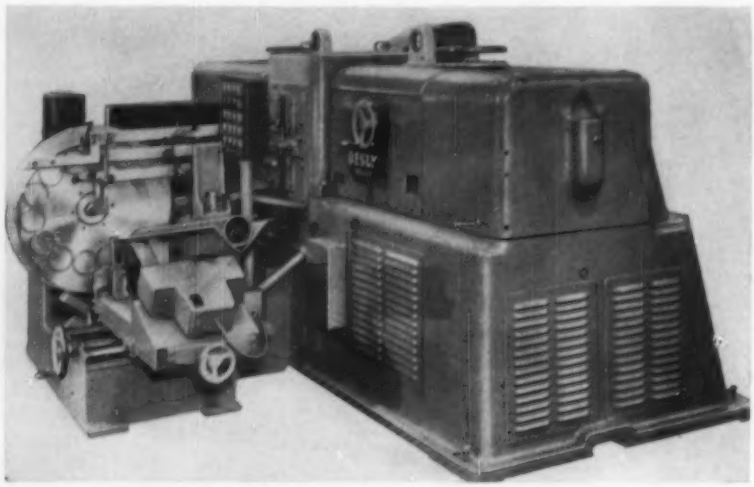
Moving the control causes the shearing attachment to double-shear samples from wire test rolls. Attachment is capable of shearing 10 different diameters of wire without tool change. Sheared sample falls into a trough and rolls to a box at operator's right. Operator places sample in the upsetting attachment, then moves lever which closes press to upset the sample.

Specifications: stroke, 3 in.; lower platens, 9 x 9 in., speed, 14 ipm; daylight of 10 in. for shearing attachment and 8 in. for upsetting attachment.

Williams-White & Co, 600 3rd Ave, Moline, Ill



BARSTOCK HANDLER called Bar-Lugger weighs 40 lb, attaches to plant overhead conveyor. Device will handle square, round, or hex stock up to 6-in. dia. Price is $84.50—*Industrial East Co, PO Box 561, Clifton, NJ*



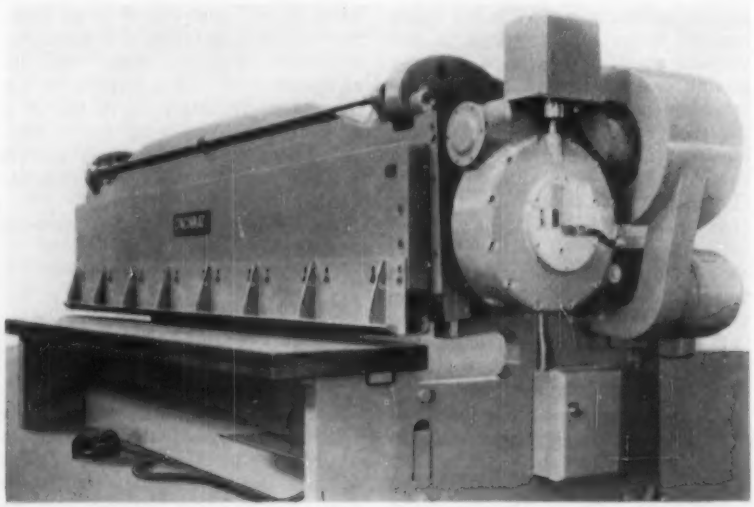
Besly Double Disk Grinder Has Pushbutton Controls on Both Sides

No. 240 30-in. double horizontal disk grinder has all spindle motors contained within a broad, low, easily accessible base. Pushbutton controls on both sides are incorporated in design, so that dressing, changes, and down time are said to be considerably reduced.

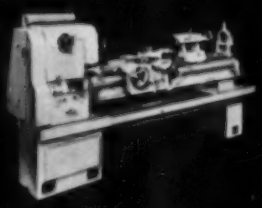
Features include sealed spindle quill construction, automatic pushbutton dressing, automatic sizing to adjust for disk wear, neoprene-sealed head assembly for protection against dust and coolant, fast magnetic rotary through feed, and easy disk removal.

Maker claims accuracy of 0.0001 in. for parallelism, and stresses usefulness of machine for such operations as high-speed finishing of piston rings, bearing rings, automatic transmission plates, and similar shapes.

Besly-Welles Corp, South Beloit, Ill



STEEL MESH used to reinforce concrete highways is cut on special Series 4314 shear. No hold-downs are required to hold the material while the cut is being made. An adjustable material guide is provided to prevent material from "tipping up" during the cut. Machine also features electric clutch control and is set up in conjunction with automatic material-feeding units that minimize manual handling—*Cincinnati Shaper Co, Hopple, Garrard & Elam Sts, Cincinnati 25, Ohio*



ELECTRICAL EQUIPMENT MAKERS know the production penalties of obsolete machine tools. They know, too, that half their 43,000 drilling machines and 45,000 lathes are over 10 years old.* Replacement and modernization has already started in this industry. It needs starting all over the country, for half our machine tools were built to World War II standards. Our enemies know this and so do your biggest competitors.

Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

*Figures from American Machinist's Seventh Inventory.

PRINTED IN U.S.A.

center on... **cincinnati lathes and drills**

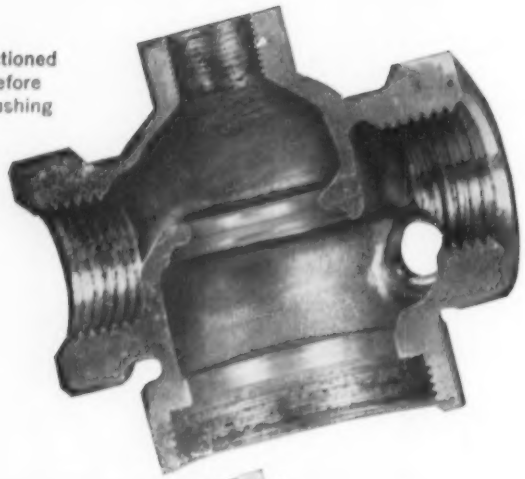
Machines shown are Cincinnati's new 16" Sliding Head Drill and 15" Tray-Top Lathe.

East Co, PO Box 561, Clifton, NJ Ohio

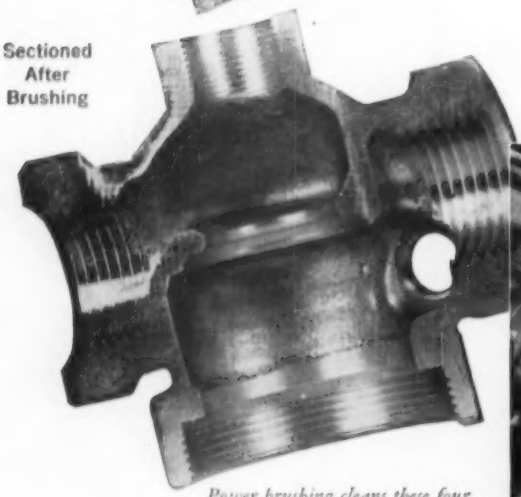
OSBORN BRUSHING METHODS worthy of your confidence

Solving an inside job

Sectioned Before Brushing



Sectioned After Brushing

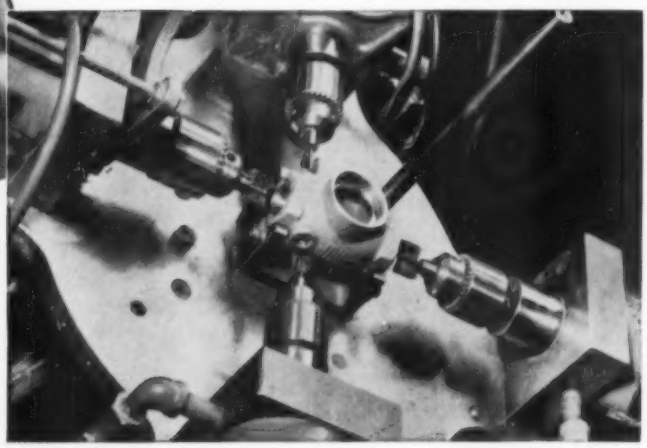


Power brushing cleans these four threaded holes 66% faster than previous method.

● Removing burrs and metallic particles from threads inside this valve body was once a tedious, time-consuming hand operation.

Today, using Osborn Situft® Brushes and a simple power brushing setup, the four threaded ports in this valve are deburred and cleaned in one operation . . . *saving eight manhours per 1000 parts.*

This and hundreds of other metal cleaning and finishing improvements made possible by power brushing are the reasons why Osborn has earned industry's confidence. An **O**sborn **B**rushing **A**nalysis, made at no obligation, will show how *you* can make substantial savings on many types of production with Osborn Power Brushing. Write *The Osborn Manufacturing Company, Dept. C-52, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Osborn Brushes

FYI

FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

• AUTOMATIC MULTI - CYCLE LATHE—*Monarch Machine Tool Co, Sidney, Ohio.* 24-page bulletin 1808 illustrates features of Model 21 Mona-Matic; describes multi-cycle programmer control system, air-gage tracer mechanism, constant surface cutting speed control, and optional automation system for completely mechanized work handling. Request direct on company letterhead.

1 DIE-CASTING MACHINES—*Cleveland Automatic Machine Co, 4932 Beech St, Cincinnati 12, Ohio.* 8-page bulletin gives details on Model 600, a universal high-pressure, hydraulic unit with rated 600-ton pressure (strain-gage tested), available as cold or hot chamber machines.

2 CENTERLESS GRINDER — *Van Norman Machine Co, Springfield 7, Mass.* 4-page folder contains description of Model 2C with work capacity of 0 to 4¾-in. dia. Heavy-duty unit-type grinding wheel spindle with 15-hp drive motor illustrated; specifications, accessory equipment for infeed and through-feed operations listed.

3 SWAGING MACHINES—*Fenn Manufacturing Co, Fenn Rd, Newington, Conn.* 16-page catalog SM56 pictures and describes line of equipment. Contains basic technical information on rotary swaging process, principles of operation and advantages, explains variety of applications. Features and specifications of machines covered.

4 MECHANICAL C-FRAME PUNCHES AND SHEARS—*Williams-White & Co, Moline, Ill.* 8-page form 74 presents data on models in various capacities and throat depths, single or double end; variety of units illustrated and described.

5 ROLLING MILLS—*Waterbury Farrel Foundry & Machine Co, Waterbury, Conn.* 36-page illustrated catalog R covers complete line of mills and auxiliary equipment for ferrous and non-ferrous metal; 25 different types of machinery include strip, rod, and special mills, gang slitters and chain draw benches; reference tables include strip coil weight and length calculating graphs and tandem rod mill rolling schedules.

TOOLS AND ACCESSORIES

6 SOLID CARBIDE TOOLS—*Atrax Co, Newington, Conn.* 100-page revised catalog describes new Atrax items including miniature hole grinding burs, 1544 series routers. Engineering data, information on care and use of tools, 28-page price list on entire line.

7 DIESETS AND ACCESSORIES — *Producto Machine Co, 990 Housatonic Ave, Bridgeport 1, Conn.* 76-page catalog 11 includes 56-page technical section and 20-page net price book bound so that they can be read simultaneously. New items illustrated and described include rectangular progressive rear pin diesets; fourslide and dieing machines; line of chrome-vanadium steel die springs; lubrication devices; bolster plates and toolroom equipment.

8 METERED LUBRICATION FOR SMALL MACHINES—*Bijur Lubrication Corp, 151 W Passaic St, Rochelle Park, NJ.* 24-page bulletin 4C illustrates and describes automatic and semi-automatic centralized systems. Selection factors, distribution systems, installation details covered.

9 CARBIDE-TIPPED SAW BLADES —*Forrest Manufacturing Co, PO Box 188, Rutherford, NJ.* 8-page bulletin pictures and describes metalworking, plastics, and special cutting blades for variety of applications. Design features and construction details discussed.

10 MAGNETIC PARTICLE INSPECTION—*Magnaflux Corp, 7300 W Lawrence Ave, Chicago 31, Ill.* 16-page illustrated booklet presents data on Magnaflux-Magnaglo process for nondestructive testing. Equipment and applications discussed, as well as uses and advantages.

11 GRINDING WHEEL ADAPTERS—*Wm Sopko & Sons Co, 140 E 267th St, Euclid 32, Ohio.* 8-page catalog gives details on line of adapters and toolroom and grinding room accessories. Four styles illustrated and described for wheels from ⅛ to 2 in. in width, with both LH and RH threads; reversible wheel units for diamond wheel use, and long extended-type adapter discussed.

12 TUBE-WORKING TOOLS—*Parker Appliance Co, Tube & Hose Fittings*

Name .....
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Company .....
Co. Address .....
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AMERICAN MACHINIST, 12-17-56 *Not good after Feb. 17, 1957*

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American Machinist
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FYI
FOR YOUR INFORMATION

Div, 17325 Euclid Ave, Cleveland 12, Ohio. 24-page catalog 1140 pictures and describes hand tools including tube cutters, flarers, benders; also bench-mounted benders, power flarer, straight thread tapping and counter-boring tools. Includes specifications and detailed how-to-use section.

13 POLISHING AND GRINDING WHEELS—*Minnesota Mining & Manufacturing Co, 900 Fauquier St, St Paul 6, Minn.* 12-page publication illustrates applications of PG wheels in case history form. Large size wheels are designed for use on floor lathes, semi-automatics, and fully automatic polishing machines, rotary or straight line. Portable units are for floor and bench lathes, portable and flexible shaft grinders.

HEAT TREATING AND WELDING

14 BOX FURNACES—*General Electric Co, Schenectady 5, NY.* 4-page bulletin GEC-1402 includes specifications, temperatures, ratings, and dimensions of GE box-type units with cooling chambers, for low production and laboratory applications.

15 MECHANIZED HEAT TREATING —*Surface Combustion Corp, Toledo 1, Ohio.* 8-page bulletin SC-176 discusses economic features of completely mechanized heat treat lines. 24 basic mechanisms shown with isometric drawings; photos and diagrams illustrate steps to be used in building automated lines for any size of operation.

16 EUTECTIC WELDING INSTITUTE MANUAL—*Eutectic Welding Alloys Corp, 40-40 172 St, Flushing 58, NY.* 56-page illustrated manual (TIS 2572) including data on latest low-temp welding alloys is a complete handbook on metal joining and repair procedures. Seven sections cover welding of steels, stainless, nickel and nickel alloys, cast iron, aluminum, copper and copper alloys, and difficult-to-weld base metals such as magnesium.

PLANT SERVICE EQUIPMENT

17 BLAST CLEANING ABRASIVES—*Pangborn Corp, Hagerstown, Md.* 12-page illustrated manual, bulletin 538, gives details on complete line including characteristics, application, and selection. Tables give sizes and screen specifications as well as SAE classifications and size designations of shot and grit. Typical installations of equipment pictured.

18 HOISTING EQUIPMENT—*Yale & Towne Manufacturing Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna.* 44-page catalog covers features and specifications of lines of hand hoists, Pul-Lifts, and plain and geared hand-hoist trolleys. Product information and selection data included.

19 VENTILATING AND EXHAUST SYSTEMS—*American Agile Corp, PO Box 188, Bedford, Ohio.* 12-page illustrated brochure presents information on thermoplastic corrosion-proof centrifugal fans, ducting and fittings, and hoods. Variety of models specified; positions and arrangements to meet specific operating conditions discussed.

20 SHOP EQUIPMENT—*Equipto, Division of Aurora Equipment Co, Aurora, Ill.* 48-page booklet 485 covers all types of steel shelving, drawers, lockers, work benches and tables, storage, warehouse, and shop equipment.

21 SPRAY WASHING COMPOUNDS—*Magnus Chemical Co, Garwood, NJ.* 4-page bulletin 73 describes three new nonfoaming compounds, Magnus X-3 series, in three strengths for cleaning hard, medium, and soft metals.

22 INDUSTRIAL LIGHTING—*Sylvania Electric Products Inc, Wheeling, W Va.* 28-page booklet contains illustrated, descriptive sections on safety and visibility factors; standards for use in prescribing plant lighting; uses of fluorescent, incandescent, and mercury vapor lamps; lighting of other areas; maintenance; and condensed catalog data on fixtures.

23 COLD GALVANIZING COMPOUND —*American Solder & Flux Co, 19th & Willard Sts, Philadelphia 40, Penna.* 4-page folder gives details on Drygalv; product rustproofs iron and steel surfaces, prevents corrosion at welded joints, and repairs damaged galvanized surfaces.

PARTS AND MATERIALS

24 ELECTRIC MOTORS—*Sterling Electric Motors Inc, 5401 Telegraph Rd, Los Angeles 22, Calif.* 20-page condensed catalog illustrates and describes normal speed units, geared motors, variable speed transmissions, and speed reducers. Drive selection data in tabular form; list prices, frame sizes, modifications and accessories included.

25 EPOXY RESIN ADHESIVES—*Adhesives & Coatings Div, Minnesota Mining & Manufacturing Co, 423 Piquette Ave, Detroit 2, Mich.* 11-page technical bulletin gives engineering data on five high-strength adhesives for general purpose metal-to-metal bonding, honeycomb sandwich construction, permanent anchor for metal and plastic parts, tool repairing, sealer and crack filler. Includes properties and performance data, product description, application and curing procedures.

26 PRECISION INSTRUMENT COMPONENTS—*PIC Design Corp, Division of Benrus Watch Co, 477 Atlantic Ave, E Rockaway, LI, NY.* 128-page catalog 11 contains concise engineering data on 4000 precision instruments and servo parts available from stock.

27 FLEXIBLE METAL HOSE AND TUBING — *American Brass Co, American Metal Hose Division, 665 S Main St, Waterbury 20, Conn.* 64-page catalog G-560 contains specifications, bend diameters, lengths, types, construction diagrams, and descriptions of end fittings.

28 MOTOR SELECTOR—*Reliance Electric & Engineering Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio.* 12-page illustrated bulletin B-2103-1 gives detailed data on how to select ac motors for specific applications. Covers speed-frequency relationship, NEMA design classes, torque characteristics, NEMA current and torque values, frame selection tables, dimension charts and mechanical modifications for all sizes from 182 to 6085.

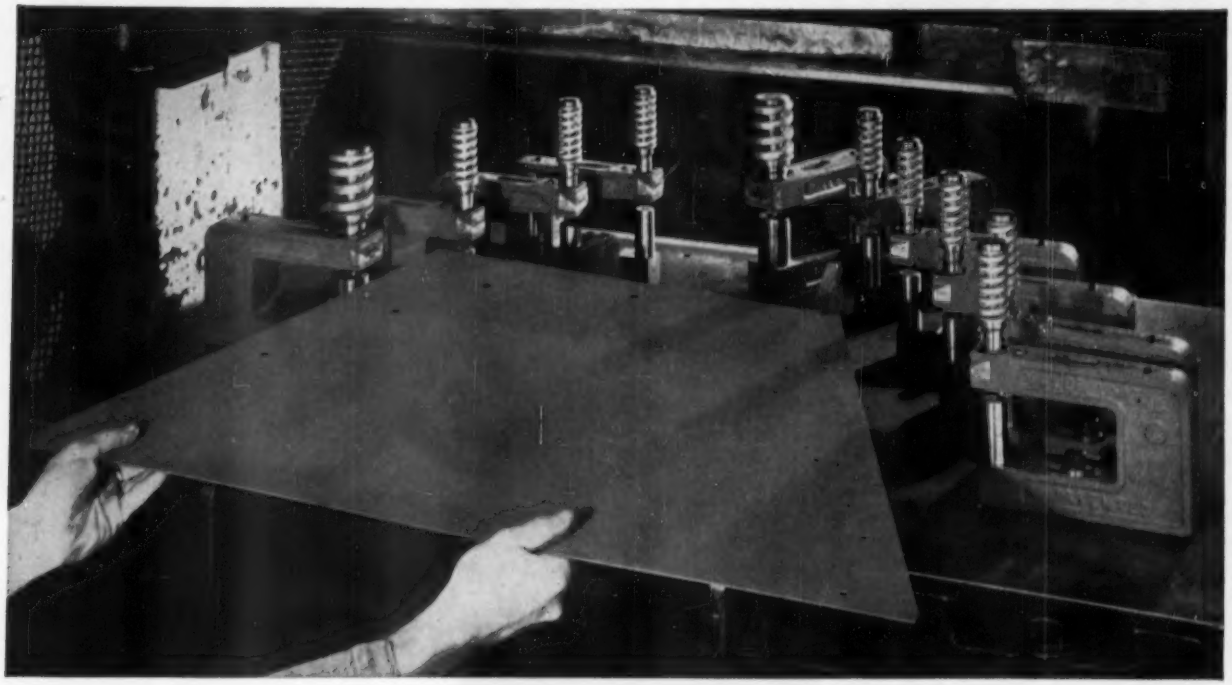
29 FLEXIBLE COUPLINGS — *Morse Chain Co, Ithaca, NY.* 24-page catalog C 41-56 contains detailed information on torsionally flexible Morflex units. Principle, employing preloaded rubber biscuits as flexible medium, is explained and illustrated. Complete dimensions and specifications given on standard, double, and radial-type couplings, with additional data on coupling driveshafts. Torsional deflection charts and instructions for use included.

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Omega Punches, Used in Multiple Units, Provide Big Savings in Metal Punching

If you'd like to see some interesting metal-punching jobs, the place to visit is Wales-Strippit Company, at North Tonawanda, N. Y. There they employ about every punching operation imaginable, using self-contained punching units which are set up quickly to meet the requirements for varied hole sizes or shapes.

One of the tool steel grades which has been doing a fine job of minimizing shop costs at Wales-Strippit Company is Bethlehem Omega, a super-tough steel supplied by Leed Steel Co., Buffalo. Omega's dependability and long service life have been remarkable . . . all the more so because it is used exclusively in punching hard metals, where high shock-resistance heads the list of requirements.

Omega is our "super" grade of oil-hardening, shock-resisting tool steel. It can also be quenched in water. Here's its typical analysis:

C	Mn	Si	Mo	Va
0.60	0.70	1.85	0.45	0.25

Omega isn't limited to service in punches, either. It's just what the doctor ordered for hand and pneumatic chipping chisels, knockout pins, swaging dies, shear blades, and other uses where the steel is continually subjected to severe shock.

Making Plastic Parts? Use Lustre-Die

Lustre-Die, our new plastic-molding tool steel, is really something! What a high polish it takes! And what high lustre you get on the finished parts! Lustre-Die has a well-balanced analysis, and is alloy fortified to increase its depth of hardenability and mechanical properties. It's good steel. You'll like it.

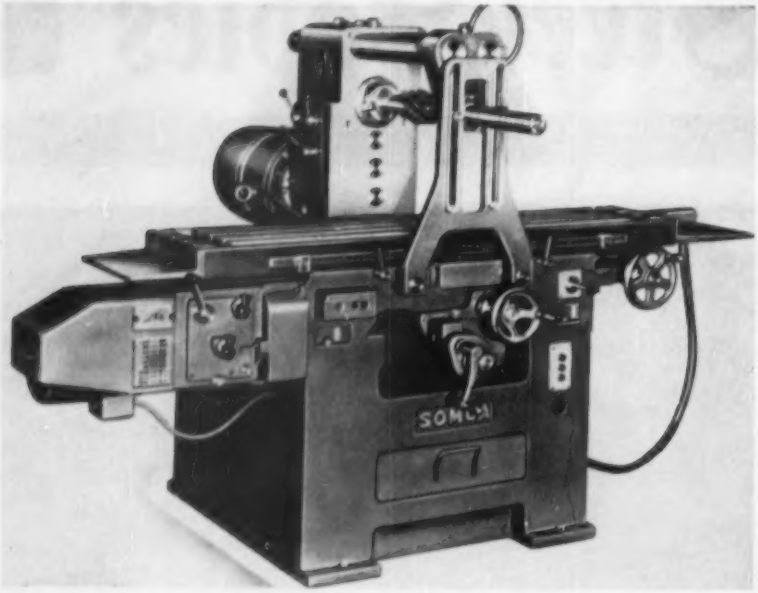
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Oxide Skin Improves Lehigh H

Most users of hot-work steels know that the oxide skin, put on the surface of tools by the second temper, is beneficial. This oxide coating serves partly as a lubricant, and also helps conventional lubricants to adhere, thus increasing wear-resistance.

When tempers above 900 F are used, Lehigh H tool steel is also benefited in the same way by the oxide coating resulting from the second temper. Here is the sequence of operations to be followed in heat-treating Lehigh H, so as to take advantage of the oxide coating:

1. Heat the tool and quench it in the conventional manner.
2. Temper at 925 F (or higher for some purposes).
3. Grind the tool to size, and remove scale and decarburization.
4. Retemper the tool at 900 F. Do not grind or remove the light oxide coating—use the tool with this surface.



Bed Design on French Miller Provides Extra Stability

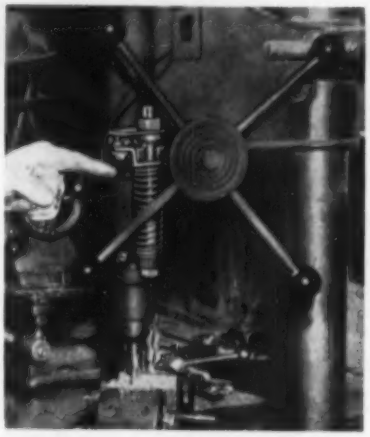
The Somua Series Z milling machine, made by Societe Saviem of Paris, France, is offered in two models which feature a cross-travel arrangement that differs from traditional bed-type design. Table carrying the workpiece rests directly on the bed, offering greater stability than conventional knee-type units. The knee, no longer fixed to the column by its lateral face alone, slides horizontally in the bed, which supports it along its entire length, whatever its position during cross motion.

Upright carrying the spindle is slender rather than massive; it slides along in long vertical guides fitted to the knee. This upright head also serves as spindle gearbox and supports the braked driving motor.

Machines are made in two models, Z-1 and Z-3, and can accommodate vertical and universal heads, universal dividers, and circular tables. Model Z-3 (illustrated in horizontal setup) is said to be the first milling machine made to execute rectangular automatic cycles; a special attachment also adapts it for climb milling. For the milling of aluminum, other light metals, and plastics, a variant of Model Z-1 (Model Z-1-ALU) is available.

Model Z-1 has 11¾ x 39-in. table and is provided with 3-hp spindle-drive motor; ranges are 28-in. longitudinal, 9¾-in. cross, and 15¾-in. vertical. Model Z-3 has 14½ x 63-in. table, 10-hp spindle-drive motor; longitudinal, cross, and vertical ranges are 39, 12¾, and 17¼ in.

Imported by Wickmann, Ltd, 28 Water St, New York 4, NY

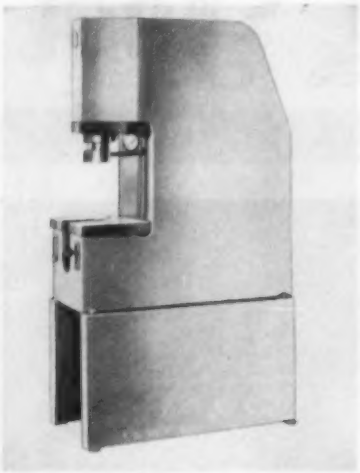


Drillpress Attachment Provides Automatic Downfeed, Shutoff

Automatic feed device called Automator is designed for drillpresses up to ¾ in. Device provides automatic downfeed and an instantly adjustable depth stop shutoff. It also automatically applies lighter pressure at the end of the stroke to prevent burring.

An electric switch shuts off the drill when the hole is through or when stop is reached.

Diamond Tool Co, Dept A-1, Box 32, South Haven, Mich



Hydraulic Press Line Is Augmented by Northern

Additions to line of hydraulic presses trademarked Proven Power include 7½ and 15-ton models. Presses are designed for a wide variety of operations, such as broaching, staking, forming, pressing, embossing, bending, trimming, stamping, shaping, and swedging.

A slight movement of the control lever starts the ram in motion. At bottom of stroke the control lever is released and the ram returns automatically to a pre-set stop. Stop may be set any distance from ¼ in. to the full stroke of 12 in.

7½-ton model is available with closing speed up to 265 ipm, pressing speed to 240 ipm, and return speed to 400 ipm. On the 15-ton model, closing, pressing, and return speeds are 270, 120, and 345 ipm.

Northern Tool & Machine Co, 1545 N 31st Ave, Melrose Park, Ill

Chain wrenches are available in two models with capacities of ½ to 4 in. and 3 to 6 in. Wrench jaw is constructed so that the greater the force on the handle, the tighter the grip. Chain will fit round, hex, square, and all irregular shapes.

Toledo Pipe Threading Machine Co, Toledo, Ohio

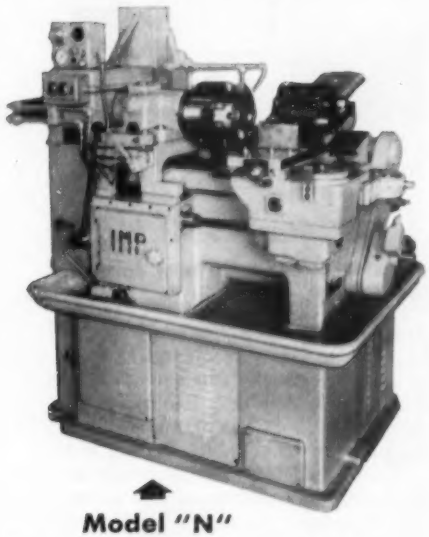
Solvent detergent, Oakite Composition No. 117, is a clear liquid designed to remove grease, oil, and smut from machinery where water cannot be used. Material has a flash point of 185 F; exposure tolerance rating is 2½ times greater than that of trichlorethylene and 20 times that of carbon tetrachloride.

Oakite Products, Inc, 124 Rector St, New York 6, NY

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

NEW PLATEN-TYPE AUTOMATIC LATHES CUT BORING, FACING AND TURNING COSTS



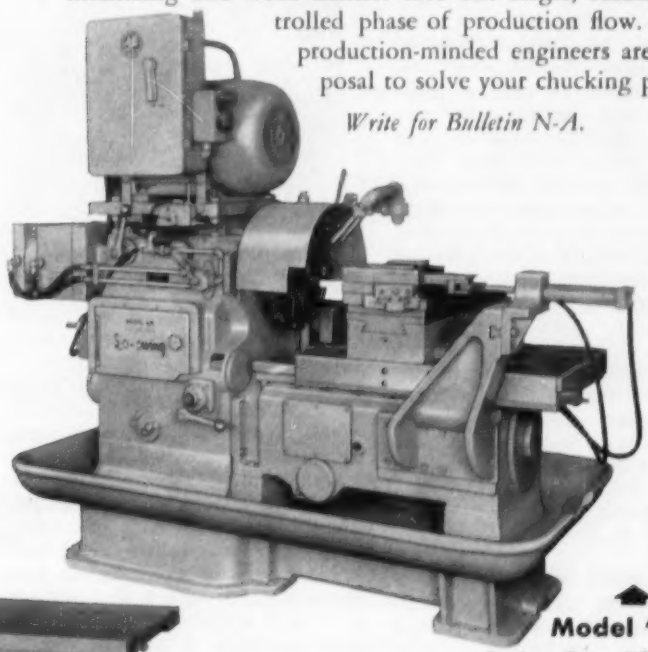
Model "N"
Swing Over Platen . . . 11"
H. P. Capacity 5

The NEW Seneca Falls Platen Type Automatic Lathes have been designed principally as chucking machines adaptable to a wide variety of work requiring large swing capacity, high spindle speeds, multiple tooling and fast cycling operation.

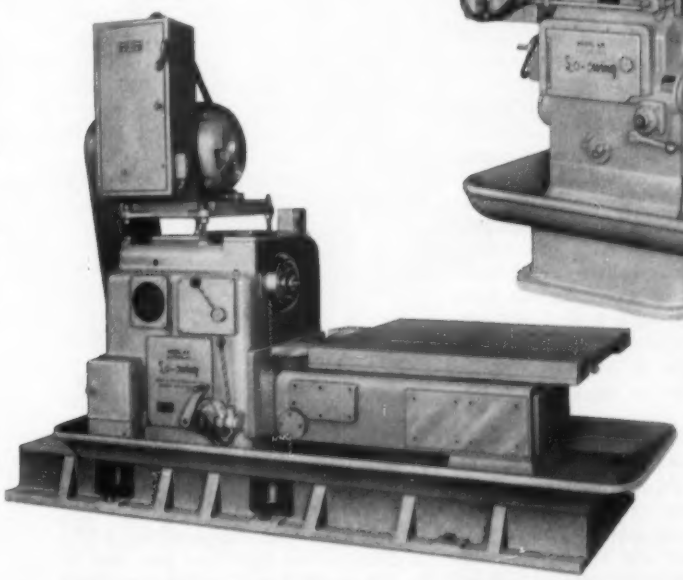
The platens have cam operated longitudinal and cross feeds and may be equipped with angular feeding slides and other special attachments suitable for customer's work.

All three types of machines may be equipped with Seneca Falls Automatic Loading and Transfer Equipment which provides means to extend automaticity to individual machines or through a series of successive, though dissimilar, operations to combine work loading, machining and work transfer into one single, automatically controlled phase of production flow. Seneca Falls production-minded engineers are at your disposal to solve your chucking problems.

Write for Bulletin N-A.

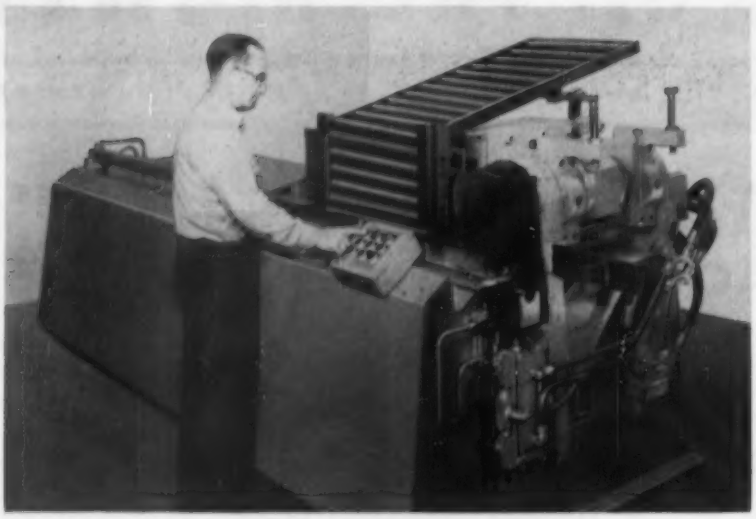


Model "LN"
Swing Over Platen . . . 18"
H. P. Capacity 20



Model "AN"
Swing Over Platen . . . 24"
H. P. Capacity 40

SENECA FALLS PLATEN-TYPE, CAM-OPERATED AUTOMATIC LATHES



Hill High-Speed Bending Machine Bends 2-in. Steel Tubes in 4 Sec

Magazine-fed, high-speed automatic tube-bending machine is a heavy-duty unit which reportedly will bend 2-in.-dia steel tubes 90° in a 4-sec bending cycle. Machine, which can be readily adapted for bending such parts as automotive exhaust pipes or gasoline-tank filler necks, can provide bends adjustable to as much as 180°. On bends with short legs, machine will operate continuously, including automatic part ejection.

Design, which provides for bending tubing in a vertical plane, provides maximum operator safety. A single-rotation hydraulic rotary actuator gives smooth, continuous power throughout the bending cycle. A two-pump hydraulic unit controls a 2000-psi clamping system and a 1000-psi bending system.

Machine has a welded steel base, is about 10 ft long, 4 ft wide, and 5 ft high.

Walter P Hill, Inc, 22184 Telegraph Rd, Detroit 19, Mich

Ultra-thin metal strip held to very close thickness tolerances can be furnished in widths up to 4 in. and in thicknesses from 0.010 in. down to 0.00012 in. Thickness is guaranteed uniform to a tolerance of 0.00005 in. Strip can be produced in a wide range of metals, from the very hard high-temperature-resistant alloys down to the very soft light metals, from metal furnished by the customer or by the company. Strip can also be slit to smaller widths, in ribbons as narrow as 0.04 in.

Allied Products Div, Hamilton Watch Co, Lancaster, Penna

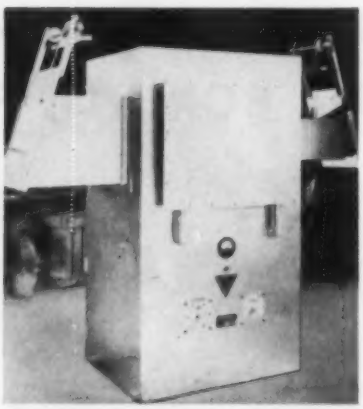
Tipp Instruments Control A Variety of Functions

Control and monitoring of virtually any chemical or mechanical condition that can be measured electrically is reportedly possible with a line of packaged industrial controls. Included among the functions that can be controlled are voltage, current, torque, timing, pressure, temperature, liquid level, speed, depth, light, sound, and deflection.

Controls are effective over a variety of ranges for each function. Sensitivities begin with 0 to 5 mu-amp or 0 to 5 millivolts. Normally the units operate on dc, but they may be adapted easily to ac in most instances.

Depending on the circuitry, units will initiate desired control action when either an increasing or a decreasing signal reaches a pre-set point. Units also are available with both high and low limits. Controls are of the indicating type, calibrated in whatever units are applicable; one pointer gives a continual reading of signal from the operation being monitored, second pointer may be turned to any place on the dial to fix the allowable signal limit. Accuracy is held to within 2% of dial settings.

Tipp Mfg Co, Tipp City, Ohio



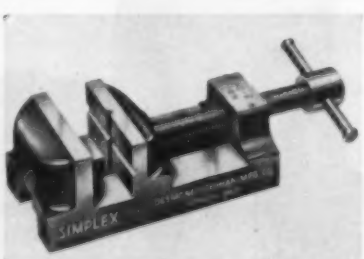
Pereny High-Temperature Furnace Operates Over Three Zones

Model SNX-81072 Pereco electric furnace provides an operating temperature of 2500 F (max temp, 2700 F), and is said to be suited to a wide variety of high-temperature heat-treating work, including brazing and sintering. Heated by silicon-carbide elements positioned over and under the chamber, furnace is a 3-zone, straight-line, manual-pusher unit.

Approximate overall size is 42 in. wide, 70 in. high, and 79 in. long. Unit has the following work areas: preheat zone, 10 x 8 x 29 in.; hot zone, 10 x 8 x 24 in.; cooling zone, 10 x 8 x 26 in.

Furnace is powered for 220v, 60c, 3-phase operation, and has all controls built in. Doors are counterbalanced.

Pereny Equipment Co, 893 Chambers Rd, Columbus 12, Ohio

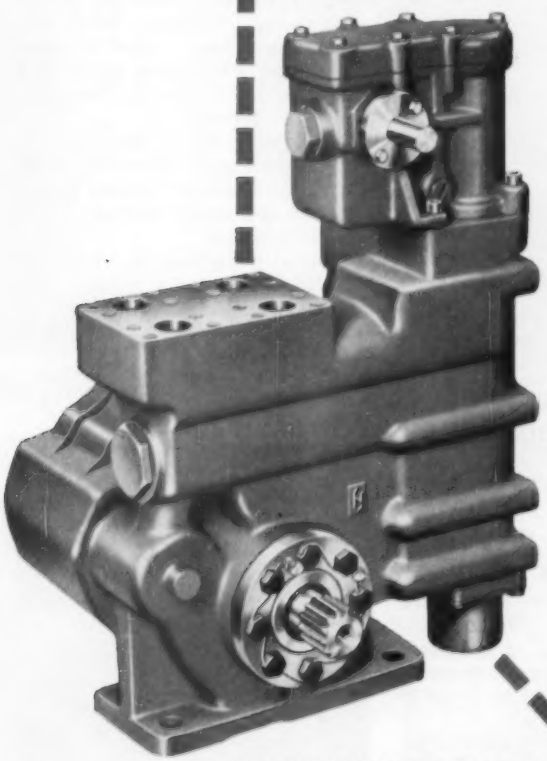


DRILLPRESS VISE, Simplex No. 3-DP, is designed for light-duty use, has 3-in. jaw width and 3-in. jaw opening. Jaw depth is 1½ in., weight is 6 lb, and over-all length is 7-5/16 in.—*Desmond-Stephan Mfg Co, Urbana, Ohio*

CUSTOM DESIGNED
FLUID POWER SYSTEMS
Start with HYDRECO®

THE PROBLEM • • •

To provide a hydraulic system for complete control of a large bulldozer affording sensitive and positive operation of the blade. The system must be extremely rugged, of minimum weight, capable of handling upwards of 160 hp and compacted into definite space limitations.



HYDRECO Fluid Power Unit combination for International Model TD-24 Bulldozer. Rated 160 gpm at 1600 rpm — 1475 psi.

THE SOLUTION • • •

HYDRECO engineers, drawing upon years of experience in solving Mobile Equipment problems, CUSTOM DESIGNED the unit shown at the left. Here, in a single assembly incorporating Pump, Control and Auxiliary Valves, HYDRECO engineers effect an answer which precisely meets all of the requirements for the International Harvester TD-24 Dozer . . . RUGGEDNESS . . . COMPACTNESS . . . WEIGHT ECONOMY . . . PERFORMANCE AND PRICE.

The ability to CUSTOM DESIGN for the specific need can be a highly advantageous facility for YOU. CUSTOM DESIGNING serves to complement the complete line of HYDRECO Fluid Power Pumps, Motors, Valves and Cylinders which are "standard" for so many famous names in Mobile Equipment.

Write for Bulletin No. 400 describing new developments in HYDRECO FLUID POWER. Your inquiry on specific design problems is a challenge the HYDRECO engineer likes to see.

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THE NEW YORK AIR BRAKE COMPANY

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INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

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9001-12 E. Michigan
Kalamazoo, Michigan

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- ☐ Copy of Bulletin No. 400.
- ☐ Further information on HYDRECO CUSTOM DESIGNING.

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Company _____

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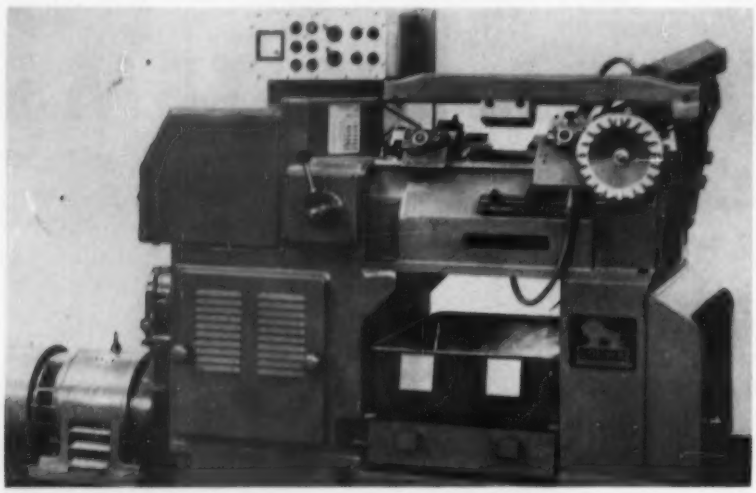
City _____ Zone _____ State _____

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Semi-Automatic Copying Lathe Offered in German Version

The Loewe Model DA-150 automatic copying lathe combines the advantages of a tracer lathe with those of an automatic cycling lathe. Slides operate independently of each other and are mounted in the rear and front of the bed, so that any automatic turning operations can be carried out during one cycle. Unit is reported equally suitable for chucking jobs or turning jobs between centers.

Machine swings 6 in. on chucking work, will take work up to 4-in. dia between centers and accommodate work up to 10 in. long. Air-operated tailstock can be supplied with spindle whose speed is synchronized with that of the main spindle.

Main motor drive is separated from machine to reduce vibration. Copying tolerances on the OD of 0.0008 in. can be maintained. Operation is by single lever, with centralized electrical control. Micrometer adjustment is provided for all slides and templets.

Imported by Eric R Bachmann Co, Inc, 37-11 41st Ave, Long Island City 1, NY

Aluminum paint, termed C-I Extra-High, is reported capable of withstanding temperatures up to 1700 F without blistering or burning. Paint is composed of a clear silicone base with a special aluminum flake pigment. It is said to form a metal coating that resists moisture, corrosion, mild acids, alkalies, and industrial fumes.

Chem Industrial Co, 3784 Ridge Rd, Brooklyn 9, Ohio

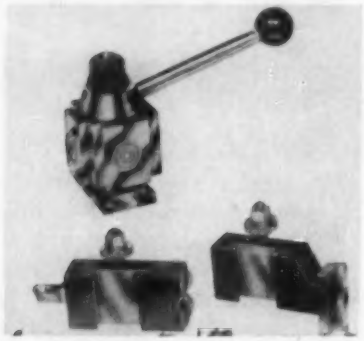
Hammond Finishing Machine Grinds, Polishes Flat Work

Model FF-12 flat finisher is designed for wet abrasive-belt grinding, polishing, and deburring of flat work such as sheets, strip, bars, stampings, and plates. Work capacity is up to 12 in. wide and 6 in. high.

Continuous feeding of work is accomplished through use of a variable-speed, air-tensioned endless conveyor. Head of the machine is of two-roll design, and employs an abrasive belt 12 in. wide by 126 in. long. It consists of a large-diameter tracking idler pulley, a heavy dovetail slide for work-height adjustment, and a contact roll driven by a motor which ranges up to 25 hp.

Other features and optional equipment include power elevation for head adjustment to work, 6- to 10-in.-dia contact rolls, adjustable work holddown rolls, magnetic conveyor platen, and automatic coolant filter.

Hammond Machinery Builders, Inc, Kalamazoo, Mich



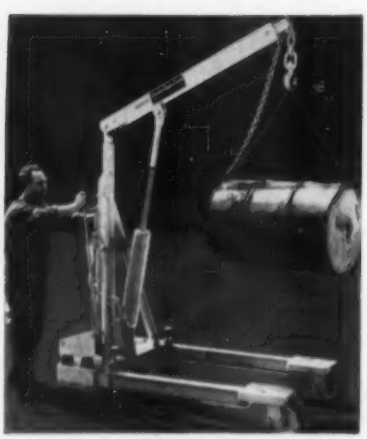
Two Toolholders Are Added To Aloris Line

Intended for use with the Aloris quick-change toolpost, two toolholders have been added to company's line: a threading holder and a combination holder for knurling, facing and turning.

Threading holder is supplied with one 60° high-speed threading blade for standard thread cutting. Blades for acme and square thread cutting are also available.

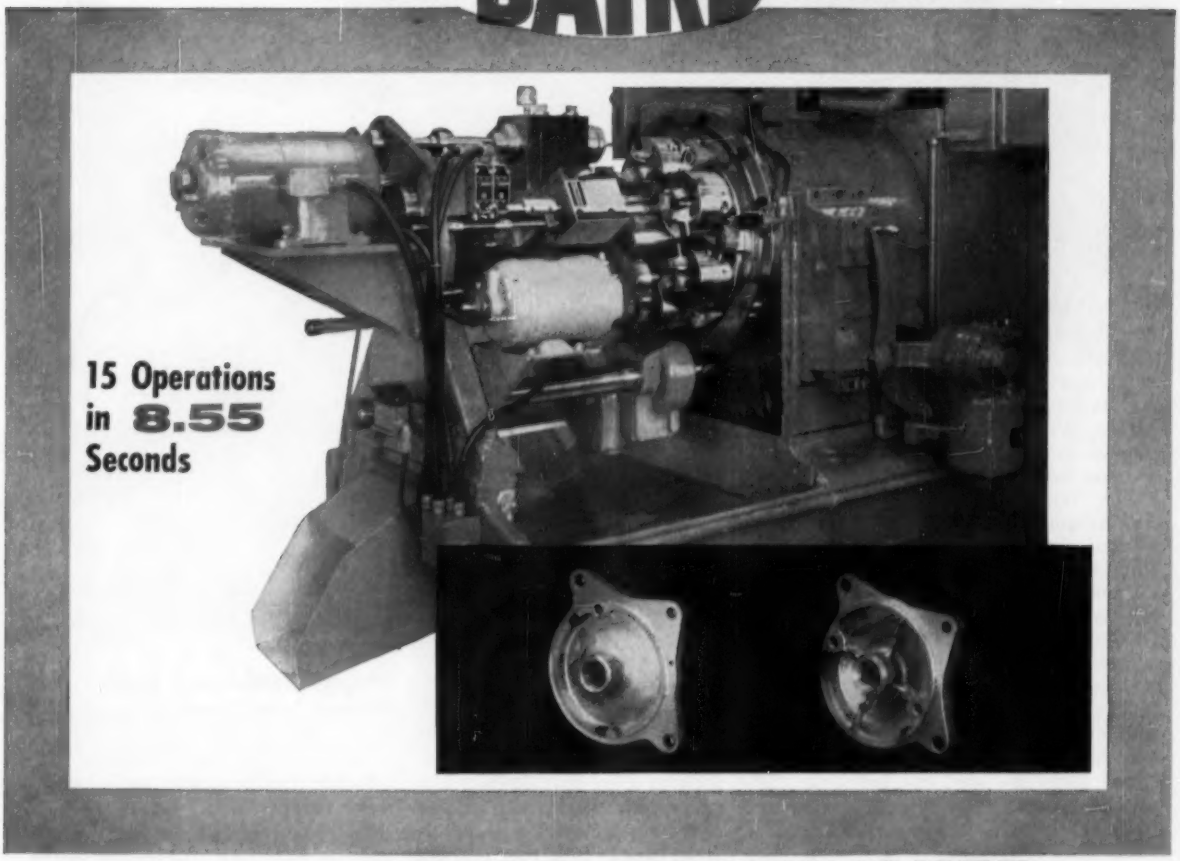
Toolpost permits quick changes of toolholders. Operator merely flips handle on the toolpost, slides out toolholder, and then slips in the next tool.

Aloris Tool Co, Inc, 131-37 Sanford Ave, Flushing 55, NY



PORTABLE HYDRAULIC FLOOR CRANE features a sliding extension beam that affords 39 in. of additional lifting length or height and adjusts to three different positions. Legs are adjustable, so that large objects can be straddled. Crane is offered in models of 1, 2, and 3 tons—*Stratton Equipment Co, 2030 E 105th St, Cleveland, Ohio*

...ask BAIRD about it



Tooling like this on a BAIRD 76H CHUCKER

can change *your* whole cost picture too . . .

industry's most versatile high production chuckers

To drop from dollars to cents in the unit cost of machining a workpiece is not unusual on a Baird installation. The secret lies in the basic design of this unusual work-rotating machine which permits practical "bug-free" tooling for an almost unlimited range of operations . . . and is equipped for single-cycle or double-indexing, with manual or auto load, auto eject, or full automation as may be required.

On the job illustrated above . . . die cast aluminum starting motor end plates . . . a feature is that only the first two of the six spindles revolve, at which time both sides of the flange are faced, both locating diameters turned, the center hole rough-bored, faced and chamfered, and inside hub back-faced and chamfered. The remaining stations, #3, #4 and #5, are stopped and accurately positioned while powered tools mounted on the tool slides finish-bore the center hole, tap two 1/4-20 holes, and bore one .313-.315 diameter hole off-center.

Sequence of Operations: Face both sides of .421-.425 flange, turn and chamfer 4.087-4.083 and 3.868 diameters, rough and finish-bore .8115-.8130 center hole, back-face and chamfer inside hub (recessing head), face and chamfer outer hub, tap two ¼-20 holes, and bore one .313-.315 diameter hole.

Production: Cycle time 8.55 seconds per piece, 421 pieces per hour gross.

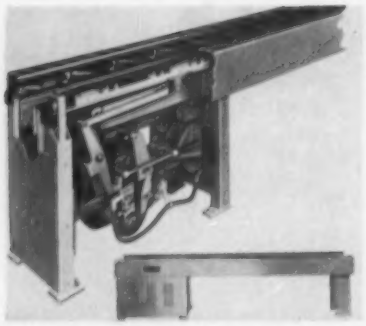
Why not put your high-volume, high-precision jobs on Baird 76H Chuckers? Even where volume is not the whole story, rapid-tooling change-over makes it a most profitable investment. Estimates and recommendations will be given on your prints or samples. Write Dept. AM.

Interested in Deferred Payment? . . . "ask Baird about it."

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

9BA56

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Dixon In-Line Transfer Table Operates Without Fixtures

Designed for handling piece parts which have a flat surface on which to slide along a track from station to station, in-line transfer table can be adapted to multiple, consecutive operations and will handle 6400 pieces per hr. Table will cam-lock parts at each station within 0.005-in. tolerance without auxiliary locating devices. When tolerance is less than 0.005 in., a short pin or locating lug on the part can be utilized.

Base support of the table contains an intermittent-drive unit and may be located at either end or in the middle of the table. Index distance can be varied from 3 to 9 in. and index time from 0.25 to 0.7 sec. Because inertia loads are low, fast indexing can be accomplished; total cycle times from 0.56 sec are available. Dwell time is adjustable.

Tables are available in lengths from 5 to 12 ft. Longer tables can be supplied on special request.

Dixon Automatic Tool, Inc, 2300 23rd Ave, Rockford, Ill

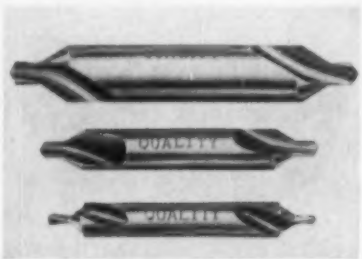
Arch Limit Switch Provides Control of Rotary Motion

Model LS-1 limit switch, engineered for close operating tolerances and consistent repeatability in high- or low-speed applications, is designed for the control of rotary motion. Exact limitation of rotary motion is achieved by two cams that are driven along a rotating leadscrew to actuate two SPDT precision snap-acting switches. Leadscrew is connected to the system to be controlled by suitable gears.

Unit features adjustability of 1 part in 3400 (0.03% of the full range) and repeatability of ± 5° of a 360° revolution of the leadscrew (0.04%). Limit of travel for the cams is from 1 to 70 turns of the leadscrew

Limits are set by pulling the calibrated scale bar forward to disengage the teeth on the perimeter of the cams, rotating the cams on the leadscrew to the desired limits, and allowing the scale bar to spring back to its original position. Cam settings are read directly on the scale bar, which is calibrated in revolutions of leadscrew.

Arch Instrument Co, Inc, 101 Holmes St, North Quincy, Mass



COMBINED DRILL AND COUNTERSINK features spiral-flute design which promotes cutting action and reduces breakage. Unit is available in bell or plain style, and in both new and old standard sizes. Special sizes can be made to order—*Quality Tool Works, Waukegan, Ill*

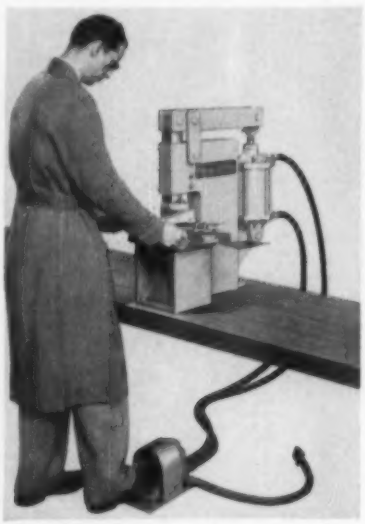
Irradiated Polyethylene Plastic Is Developed by General Electric

Plastics parts fabricated from irradiated carbon-black-filled polyethylene are being produced experimentally by GE. Known as Vulkene 107-E vulcanized reinforced polyethylene, the material is a black, tough, flexible plastic with physical properties and heat and chemical resistance reportedly superior to conventional high-pressure polyethylene, from which it is derived.

Yield strength at low temperature is said to be double that of polyethylene, and creep deformation is reduced to approx 10% of the value obtained for polyethylene. Because of its cross-linked structure, material can be carried to its decomposition temperature without melting; at 300 F it retains a tensile strength of 500 psi.

With its high carbon-black loading, material is electrically conductive. Company at present is test-marketing a modification of the material as semi-conductor tape in shielded power cable.

Chemical Development Dept, General Electric Co, 1 Plastics Ave, Pittsfield, Mass



Niagara Notcher and Punch Offered in Air-Powered Version

With 6½-ton capacity and 4¾-in. throat, air-powered notching and punching machine can be equipped with a large selection of punches and dies for simple or intricate holes, corner trimming, or combination trimming and cutoff. Machine operates on shop pressure of 80 psi.

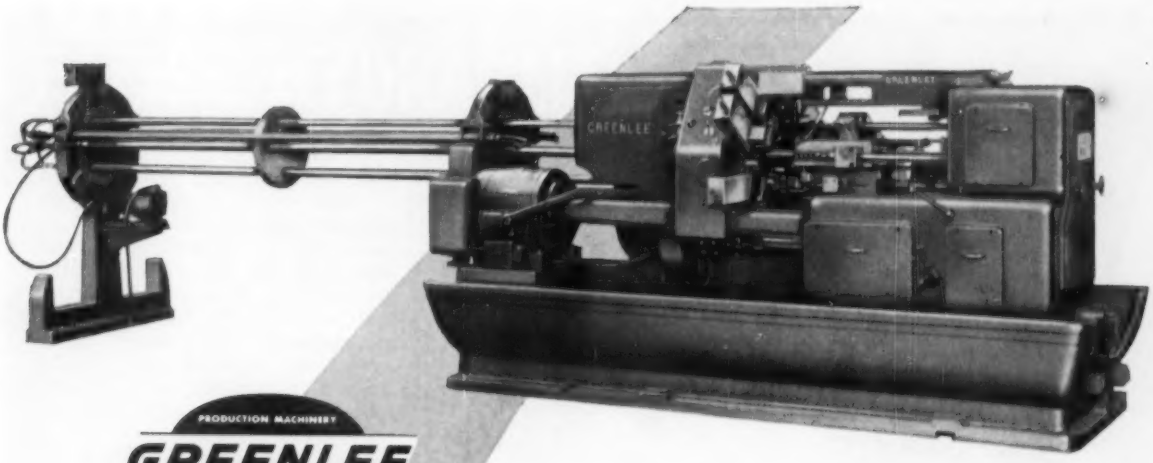
A foot valve frees both hands for locating and feeding work.The ram can be lowered gradually, to locate work at prick-punched holes and to facilitate die changing.

In a special duplex setup, two machines can be mounted on a single stand, with a single foot valve operating both units simultaneously. Optional equipment offered includes floor stand, feed table with adjustable squaring edge, and a wide variety of notching and punching attachments. Bulletin 79D.

Niagara Machine & Tool Works, 683 Northland Ave, Buffalo, NY

Crepe masking tape, No. 102 Behrcat, can be used in a wide variety of masking operations. It is said to resist temperatures of at least 275 F for one hr. Tensile strength is 20 lb per in. of width; elongation is 13.5%. Of 9-mil gage, it has an adhesion to stainless steel of 33 oz per in. of width. It is made in a full range of widths from ¼ in. upward.

Behr-Manning Co, Troy, NY



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1. Permits Greater Job Versatility
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4. Eliminates Stock Scoring
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6. Eliminates Stock Pushers
7. Eliminates Feedout Cams

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

1732 MASON AVE.
Rockford, Illinois

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

Hapman Conveyor Accommodates Heavy Stampings and Castings

Pan-Link conveyor is a heavy-duty unit for conveying items such as spiral metal turnings, stampings, castings, and forgings. No conventional chain is included in the design; instead, flat side skirts serve as links, insuring correct pitch, and also as sides to contain conveyed materials.

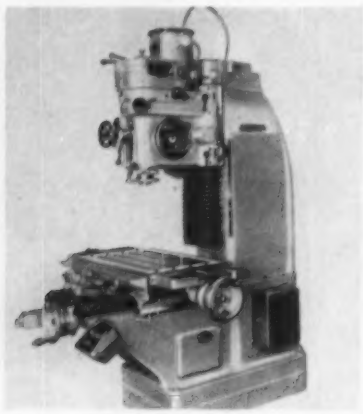
Wheels are mounted on an axle rod which passes through a set of double bushings. The smaller-diameter inner bushings are welded to the rear edge of the leading apron pan, and the larger-diameter outer bushings at both sides are welded to the leading edge of the following pan. This construction is said to eliminate abrasion and rapid wearing out of one pan edge against another when abrasive materials are carried. Coolant fluids can also drain out between pans.

Conveyor housing is a girder-like box section, with two pairs of longitudinal rails on which loaded and return apron rolls. Modular conveyor sections are built in standard 10-ft lengths for assembly to any length required. Sections are available in heavy-duty and extra-heavy construction, with pan thicknesses from 12-gage to ⅛ in. and widths from 16 to 72 in. Bulletin PL-28.

Hapman Conveyors Inc, Kalamazoo, Mich

Tote box trademarked Miracle pops open for use and pulls flat for storage. Made of double-walled corrugated paper, one-piece unit contains no stitching, stapling, or taping. It is available in sizes of 17 x 13 x 14½ in. and 15 x 12 x 10 in.

Paige Co, 114 E 32nd St, New York 16, N Y



Omega Jig Borer Measures Coordinates Three Ways

The Omega jig borer, a product of Italy, has 16 spindle speeds from 35 to 1500 rpm, and features a quick-acting, nose-type tool-changing device. Spindle is chrome-nickel steel and is mounted in precision SKF bearings. Quill moves in a heat-treated, honed liner pressed into the head and polished to a mirror finish. Maximum distance from spindle nose to table top is 20 in.

The machine offers three systems of coordinate measurement: The 20 x 32-in. table is equipped with trays for utilizing dial indicators and end-measuring rods. Machine is supplied with hardened-and-ground screws accurate to ± 0.0004 in. in the total table travel of 15 x 20 in. At additional cost an optical system equipped with projection screens is available; this system permits direct readings to 0.0001 in. and an over-all accuracy of 0.0002 in. in total table travel.

Unit is powered by a 1¼-to-2-hp two-speed motor, and weighs 4000 lb. Cost with motor, controls, trays, and reference scales is $8300.

Imported by Amitool Co, 629 Main St, Westbury, LI, NY

Magnetic Memory System Controls High-Speed Process Lines

Magdelay is designation for magnetic memory system designed for delayed control of high-speed continuous process lines and automatic sorting of items through complex conveyor systems. In the system, measurements to be remembered are used to magnetize narrow sectors of a hardened steel disk, which rotates in synchronism with the processing or conveyor line. Measurements are then read off the disk at the same time that the material that was measured reaches the action or sorting points. Read-out is accomplished no matter how slow or fast the line is moving; after read-out the disk is erased and is ready for re-use.

System accepts signals from almost all measuring devices, such as photo-electric controls, pressure switches, relays, and magnetic detectors. No exact gearing or coupling ratio need be prescribed between processing-line drive shaft and input shaft of Magdelay. Any number of measurement stations may be added on a line. Long-term reliability is assured by the absence of physical contact between the magnetic heads and the memory disk.

Automation, Inc, 212 Worcester St, Wellesley Hills 82, Mass

1500-lb-Capacity Lift Truck Has ¾-ton Lever Hoist

Model 1500 designed for moving heavy loads on skids or in bins, has 1500-lb load capacity, turning radius of 49½ in., over-all width of 25 in., length, 43 in.

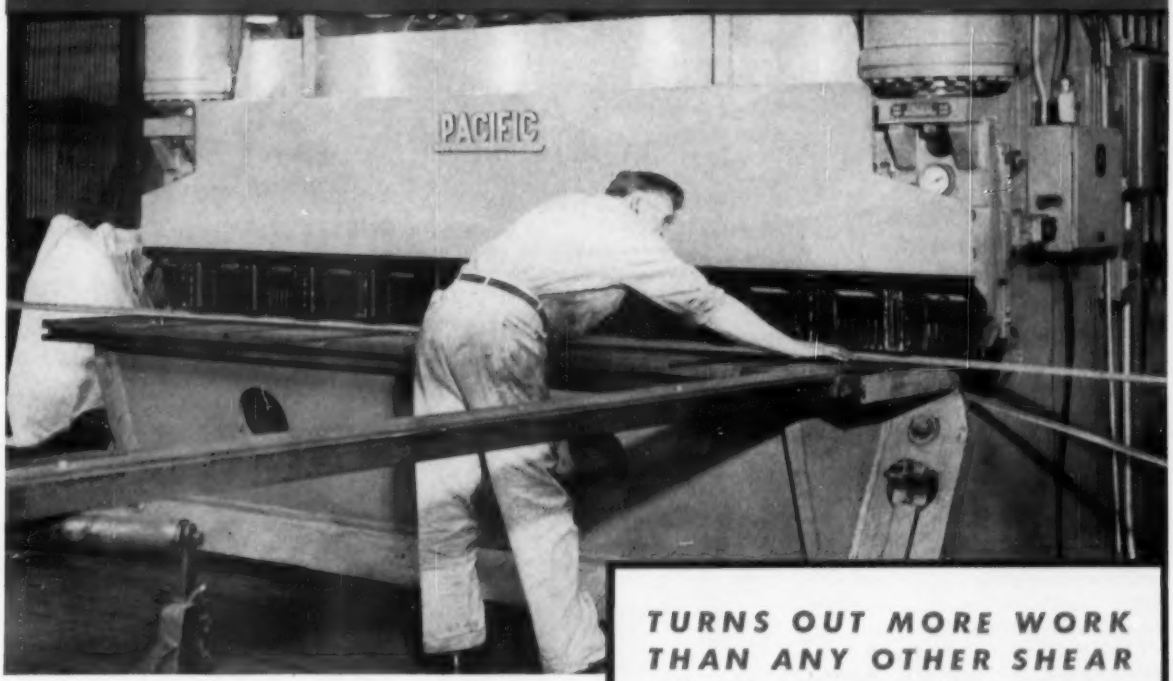
The ¾-ton lever hoist requires only 59 lb of operator effort to lift capacity load.

Thern Machine Co, 3760 W Fourth St, Winona, Minn

Hose clamps for portable welding guns can be affixed in just 3 sec. French-designed devices are round one-piece band clamps with U-shaped folds or lugs. Device is slipped on the base and crimped in place by squeezing the parallel sides of the lugs together with pliers to the tightness desired. Squeezing the lugs to the shape of the hose stresses the band beyond its original proportional limit; thus when pressure is released, the permanent set gives a tight clamp. Clamps are available in 20 sizes from ¼ to 2⅝-in. ID.

Circle Clamp Corp, 39 Broadway, New York, NY

PACIFIC HYDRAULIC SHEAR cuts sheets or heavy plate noiselessly, accurately, at lowest cost



. . . knife blade lasts longer, shear cannot be damaged by overload

Lower cost shearing can be yours with this remarkably efficient shear that eliminates shock, the main cause of blade damage and wear. Pacific Hydraulic Shear gives you speed, accuracy, safety, economy and long, trouble-free performance. It cuts soft aluminum or polished stainless without marking . . . it cuts narrow strips or trims fine edges from plates or sheets. At a single setting of the blade clearance it cuts any piece between 20 gauge sheet and full capacity. Gap type shear cuts pieces far longer than the shear length. Simple hydraulic system eliminates troublesome maintenance of mechanical shears. For production or piece work, Pacific Hydraulic Shear can be the biggest profit-making tool in your plant.

Write for literature

TURNS OUT MORE WORK THAN ANY OTHER SHEAR

Pacific speeds set up, measuring, handling and the other necessary operations that take up 95% of cutting time. It is a one-piece, welded steel structure that provides the rigidity necessary to shear heavy plates accurately. Straight-line downward pressure from 2 hydraulic cylinders keeps the shear from twisting or deforming under heavy loads. Slide ways are exceptionally long and heavy so that blade clearance is precisely maintained under heavy loads. Unique hydraulic back gauges controlled from the front rapidly move into place and can be inched slowly into the exact setting within thousandths of an inch. Blade clearance is adjusted in less than 5 minutes by calibrated screw in front of machine. Hydraulic hold-down provides positive gripping of work piece. Pressure is adjusted in seconds to match any work.

Pacific Shear is operated by movable foot pedal placed wherever most convenient. Dual control pedal available. Shear cannot be damaged by overload. Operator cannot possibly get his fingers or hands under the knife. Movement of shear either in inching or cutting is instantaneously responsive to the foot control pedal so that the blade can never get out of control.

PACIFIC INDUSTRIAL MANUFACTURING COMPANY
848 - 49TH AVENUE • OAKLAND 1, CALIFORNIA
PLANTS: OAKLAND, CALIFORNIA AND MT. CARMEL, ILLINOIS

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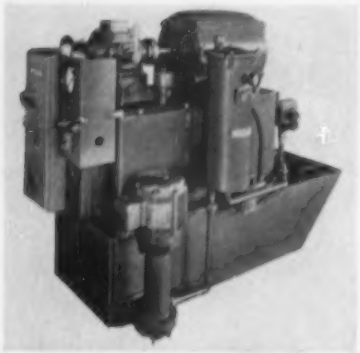


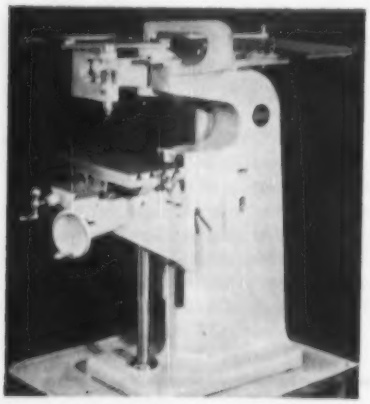
Coolant Supply Unit Adapts Drills for Deep-Hole Work

High-pressure coolant supply unit is designed to adapt standard vertical and horizontal drilling equipment for high-speed precision and deep-hole drilling. Unit provides automatic cooling, filtering, and pumping of coolant at pressures to 1000 psi and volumes to 40 gpm, with a total reservoir capacity (including settling and clean-oil tanks) of 85 gal.

Unit can supply coolant to more than one piece of drilling equipment provided the total flow does not exceed the pump's capacity. A castered dolly, furnished as an accessory, makes the unit mobile.

Control panel is wired so that a micro-switch for automatic control or a manually operated switch for coolant-flow control can be installed on the machine tool. Unit is 69 in. long, 32 in. wide, and 50 in. high.

Sealol Corp, Warwick Industrial Park, Providence 5, RI



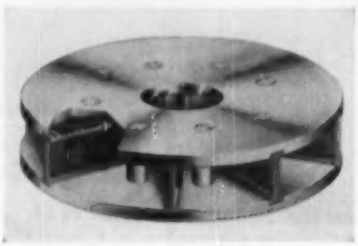
Gorton Two-Dimensional Engraver Offered in Redesigned Model

Model P1-2 engraving machine is designed to replace company's 3-U pantograph, and incorporates several design changes. Unit will swing and engrave to the center of a disk 5 in. thick by 38 in. in diameter, or a drum 11 in. high by 22-in. diameter. Pantograph ratios are from 1 to 1 up to 16 to 1, but intermediate reductions up to 40 to 1 are possible with the aid of formulas and charts furnished.

Rust-resistant, dove-tail pantograph bars and simplified slider blocks provide easier reduction settings on the redesigned machine. Work table is 6 in. longer and thicker than previous model, has larger T-slots. Copy holder is now adjustable in and out up to 5 in. for convenient set-up. Cutterhead, cutterhead link, and mounting bracket for link have been redesigned to permit closer accuracy to be built into the machine.

The heavy-duty machine also incorporates a larger, heavier cutterhead and linkage with more motor horsepower than was available in the older model.

George Gorton Machine Co, Racine, Wis



Abrasive Throwing Wheel For Airless Blast Cleaners

GM Wheelabrator unit for centrifugally propelling abrasive in airless blast cleaning is available for use on equipment already installed in plants as well as on machines being manufactured. It is currently furnished in 2½-in. wide by 19½-in.-dia size.

Blades are held in wheel by a locking device that is actually a spring arrangement. It can be inserted or removed with a screwdriver, and is outside of abrasive blast stream, therefore not subject to appreciable wear. Blades are made of a specially heat-treated alloy steel which has reportedly given twice the operating life of conventional blade material.

Wheelabrator Corp, Mishawaka, Ind

Adhesive-backed labels made of moisture-resistant tape can be supplied with customer's diagram or directions pre-printed. Zip-off liner protects adhesive up to moment of label application. Write-on surface enables customer to date, stamp or initial the label.

W H Brady Co, 727 W Glendale Ave, Milwaukee 12, Wis

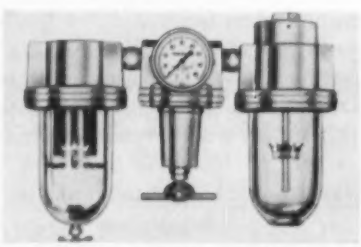
Mitchell X-Ray Units Inspect Castings, Welds, and Assemblies

Four portable industrial X-ray units are designed for the radiographic inspection of castings, welds, and assemblies. Models MS-200, MS-260, and MS-300 are designed for heavy-duty work; the fourth unit, Model MS-140, is a smaller trepanning unit for spot examination of welds and for light radiography. All units are dustproof, waterproof, and shockproof.

MA range for the three heavy-duty units is 1 to 5 ma. KV range is 55 to 200 kvp for MS-200, 70 to 260 kvp for MS-260, and 70 to 300 kvp for MS-300. Maximum steel penetration for MS-200 is 2¾ in.; MS-260, 4 in.; and MS-300, 5½ in.

Protective features: thermal relay for overload protection; flashover relay to prevent operation of unit in case of surges; voltage-sensitive relay to prevent accidental application of excessive voltage to transformer and X-ray tube; and thermal switch in X-ray head to prevent operation at excessively high oil temperatures.

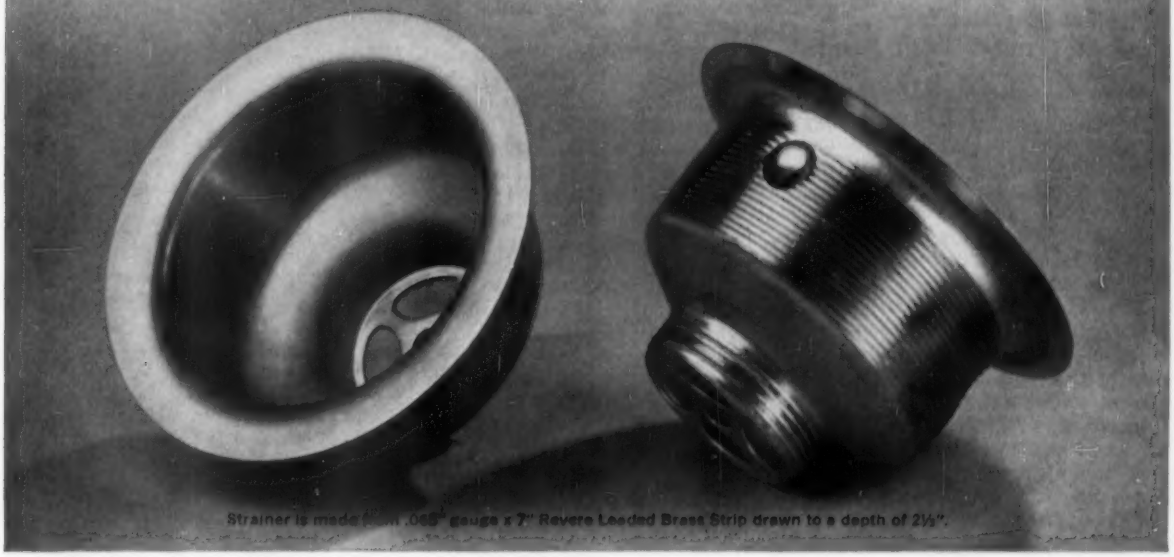
Mitchell Radiation Products Corp, 128 E Washington St, Norristown, Penna



FILTER - REGULATOR - LUBRICATOR COMBO in Crown line is designed for use in compressed air lines which service cylinders, presses, and tools. Seven styles are offered in 5 pipe sizes from ¼ to 1 in. The regulator is offered in 1¼ and 1½-in. pipe sizes also—*Hannifin Corp, 518 S Wolf Rd, Des Plaines, Ill*

2,500,000

sink strainers couldn't be wrong



Strainer is made from .068" gauge x 7" Revere Leaded Brass Strip drawn to a depth of 2½".

MICHIGAN BRASS Company saw to that by using REVERE Leaded Brass Strip

Michigan Brass has a reputation for making only quality plumbing goods. So the material for their sink strainers had to be good to start with and remain consistently so over the years. After making over two and a half million strainers from Revere Leaded Brass Strip they tell us that not only has their quality for this item been consistent, but they also have realized certain savings in production.

Here's why they use Revere Leaded Brass for their strainers:

1. The inherent corrosion resistance of brass. 2. Its deep drawing characteristics (Photo at left above shows strainer after it has been blanked and drawn in progressive die). 3. Ease of machining large diameter threads with leaded brass. 4. The excellent surface that can be developed for chrome plating (Photo above right shows strainer after it has been trimmed, dimpled, threaded and plated). 5. The consistent uniformity and quality of Revere Leaded Brass Strip over the years.

These very same characteristics of Revere Leaded Brass Strip may be the very ones that could help you retain the quality of your product over the years . . . cut your production costs. Why not have a chat with a Revere TA (Technical Advisor) and see? It costs you nothing . . . may save you plenty.

COPPER • BRASS • 1801 • REVERE • ALUMINUM

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

Wales Punching Machine Fabricates Printed-Circuit Boards

A specialized press, Model 10-AA Fabricator is designed specifically for punching printed-circuit boards. Employing a pantograph accessory called the Positive Duplicator, press reproduces any pattern of holes up to 15 x 25 in. in area from a master templet. Holes of any shape from 0.030 to 3½-in. dia can be punched cold in most dielectric materials.

Templet is clamped in the Positive Duplicator when its reference holes are located on the templet pins, and work is located by its reference holes on pilot-pin workholders. As duplicator stylus is moved to hole locations in the templet, the pantograph carriage correspondingly positions work under the Fabricator punch-holder. Depression of the stylus into each templet hole electrically actuates the punching mechanism of the press.

By reversing the above process and using a pointed stylus in a pilot printed circuit located in the Duplicator, the master templet can be punched out in the desired pattern. Because the Fabricator is a 20-ton press, steel templets up to ¼ in. thick can be punched.

Press reciprocates at 165 spm. Punch changes can be made in only 15 sec in sizes up to 1¼-in. diameter.

Wales-Strippit Corp, 345 Payne Ave, North Tonawanda, NY

Neoprene end caps for guarding pipe and tubing against internal corrosion during storage are offered in two types: lightweight roll-on cap for pipe 2 to 10 in. in dia; heavier slip-on cap for 2- to 20-in.-dia piping. Covers have wall thickness of about ⅛ in.

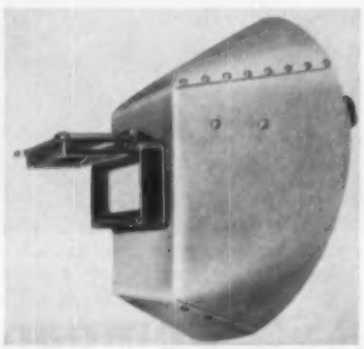
Protocap, Inc, 685 West Bldg, Houston, Texas

2½-ton High-Lift Truck

Model W-50 is equipped with heavier counterweights, heat-treated tilting mast, 42-hp Continental industrial engine, power steering, 10° back, 5° forward mast action with 8-in. free lift for easier control of loads.

Unit is 38 in. wide with a 50-in. wheelbase, has a 32-in. inside, 96-in. outside turning radii. Special forks, booms, hydraulic side shifter, tilting shovel, and other attachments are available as extra equipment.

Truck-Man Div, Knickerbocker Co, 537 Liberty St, Jackson, Mich



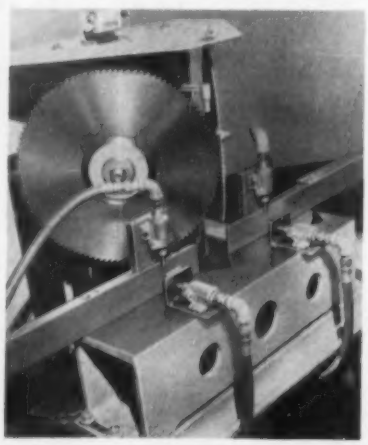
WELDING HELMET No. 668-9 made of fiber is equipped with No. 1176 Dowmetal lift-front lens holder, wide range ratchet adjustment to fit all head sizes, and padded sweatband. Bulletin 47—*Fibre-Metal Products Co, Chester, Penna*

Dow Magnesium-Thorium Alloy For Structural Airframe Material

Sheet and plate alloy designated HM21XA-T8 is the second in a series of magnesium-thorium alloys designed to combine light weight with the ability to withstand elevated temperatures. A previously announced alloy, HK31A, is reportedly surpassed in performance by the newer alloy, which offers improved properties in the 300-600 F temperature range, extends that range to at least 700 F, and at that level will withstand prolonged exposure with little effect on its properties. Material is also said to offer superior resistance to creep at elevated temperatures, while retaining other HK31A characteristics.

Alloy will be shipped from company's mill to evaluators in the T8 temper, so that customers can use it without further heat treating. Shipment will be from company's Madison, Ill, mill.

Dow Chemical Co, Midland, Mich



DOUBLE-MITER CUTOFF SAW, Model DMS-400, is constructed of cast iron. It is 56 in. high with an adjustable worktable 42 in. high. Blades are 12 in. in dia and are powered by two 2-hp motors with twin-belt transmission. Operation is by pneumatic foot control. Standard length of cut is 72 in., but can be varied to specifications—*Queens Tool Mfg Co, 15 Front St, Rockville Centre, NY*

Polar-type gear lubricant, Belex SAE No. 250, can be applied in trunnion bearings, speed reducers, hammer mills, and other heavy-duty machinery where longer gear and bearing life is desired. Lubricant is reported to have excellent rust, oxidation, and high-temperature stability.

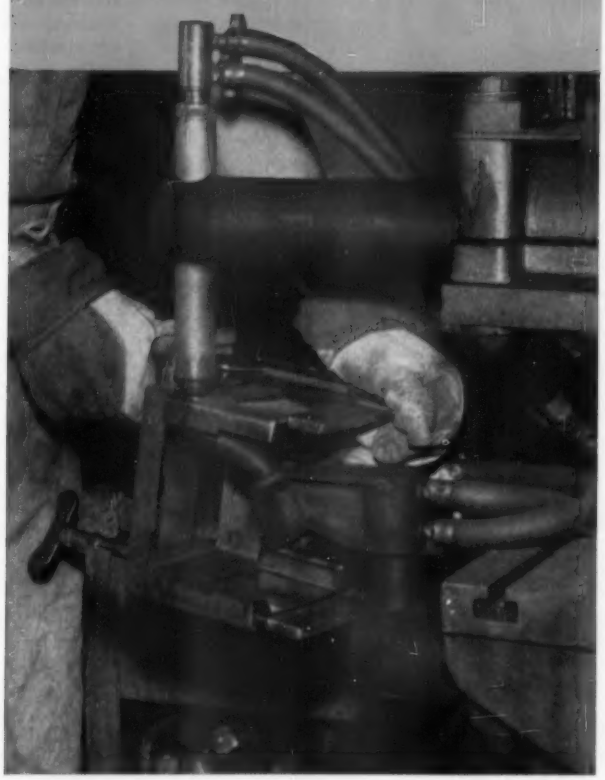
Bel-Ray Co, Inc, Dept A, Madison, NJ

Ceramic deburring shapes, designated AlSiMag 491, are custom made in desired shapes. Diameters ranging from ½ to 3 in. are reported practical for production. A fine-textured, vitreous ceramic of the alumina type, material is reported to be extremely hard.

American Lava Corp, Cherokee Blvd & Mfgrs Rd, Chattanooga 5, Tenn

Welding Output Increased

on Western Electric Coin Box Production



Suppose you needed to spot-weld sheet steel to steel forgings, in hard-to-reach locations. Western Electric's plant at Indianapolis had this problem on telephone coin boxes. Custom-designed electrodes and holders had seemed the way to do the job.

But, since using a standard Mallory heavy-duty offset holder and Mallory bent tips, their welding costs have been reduced and production rate has been increased.

Output increased. The number of parts welded per shift has been increased significantly. Reason: less tip dressing, less setup time loss, cooler operation and minimum respotting.

Longer electrode life. Replacement rate is now less. Reason: better cooling of electrodes . . . all the way to the tip.

Less down time. Re-dressing is now needed only once per shift.

Chances are that you, too, can make substantial savings in resistance welding production, by using Mallory electrodes, holders, seam welding wheels, dies, castings and forgings . . . and by taking advantage of Mallory engineering service in applying these products effectively to your problem. See your local Mallory welding distributor for prompt service, and write to us for our resistance welding catalog.

Expect more . . . Get more from

P R MALLORY & CO Inc

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals • Welding Materials

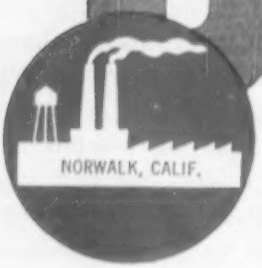
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

5 MILFORD PLANTS

. . . are within over-night trucking distance of your assembly line!

Rivets are small, but they can create "king-size" headaches when they aren't at your plant in the quantity you need—when you need them.

To give you unmatched delivery service on tubular rivets, Milford has five *manufacturing* plants and twenty sales offices strategically located across the country's industrial beltline.



TUBULAR RIVETS
COLD-FORMED PARTS
RIVET-SETTING MACHINES

To cut delivery time and production costs, to improve product appearance, to assemble your product on automatic rivet-setting machines—get in touch with Milford!

THE MILFORD RIVET

MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNSYLVANIA
ELYRIA, OHIO • AURORA, ILLINOIS • NORWALK, CALIF.

NEW SHOP EQUIPMENT

Automatic Welding Equipment Available in Two New Models

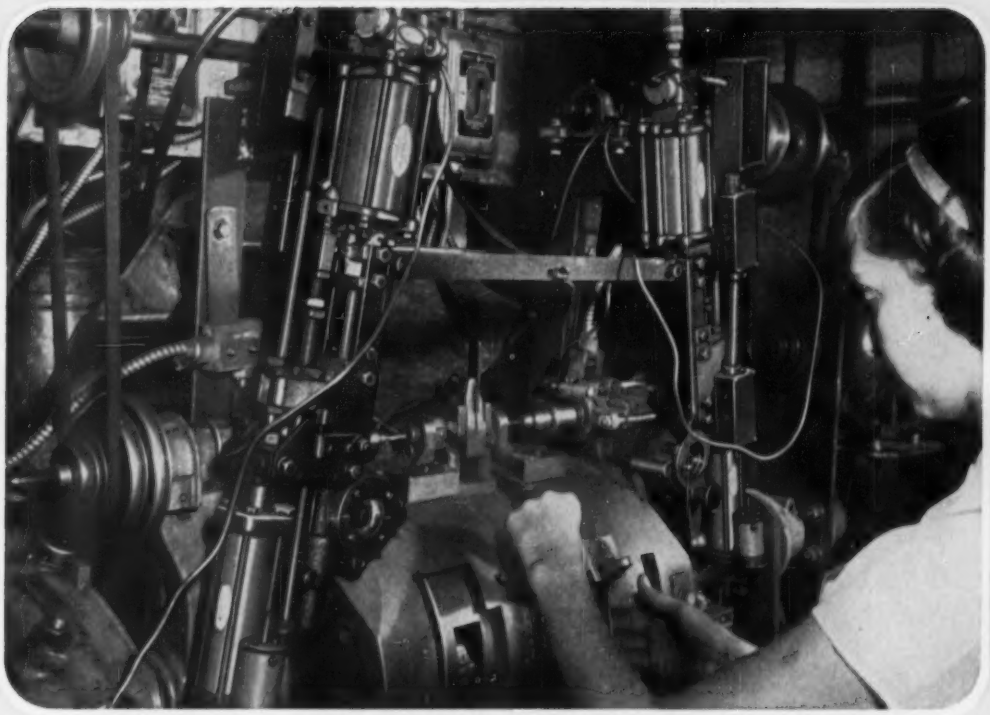
Both West-ing-arc models can be used for CO_2 gas metal-arc or submerged arc dc welding. Each air-cooled unit consists basically of a heavy-duty welding head, control, operator's remote control station, and interconnecting cables. Inching of wire, flux damping, and arc starting are performed automatically with Model SA-40A, manually with Model SA-40.

Welding head is capable of driving wire diameters from 5/64 to ¼ in. at speeds up to 300 ipm. Head motor and gear train enclosures mount together to form a single cylindrical case mounted on a universal supporting frame. Two manual adjustments permit head to be rotated 360° in two planes.

Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Penna

Constant Voltage Welder Line Includes 300 to 1200-amp Units

Main feature of the new P&H modified constant voltage machines is an adjustable slope control that reportedly gives a softer arc, eliminates burn-back and stubbing, and provides a stable, spray deposit when proper-



This special machine built in the plant of Safe Padlock & Hardware Co., drills and taps turnbuckles. It uses two Bellows Drill Press Feeds and a Bellows Rotary Feed Table. It cuts production cost 75%.

How to reduce the cost of SPECIAL MACHINES

Special machines are often the only answer to lower cost production. But for short or medium runs, special machines often just aren't practical unless they are sufficiently flexible to be readily adaptable to different jobs.

You can solve that problem of special machines by building them in your own tool room with Bellows "Controlled-Air-Power" work units. You can build them in a fraction of the time, at a fraction of the cost of expensive custom-built machines. Best of all, when the special machine has served its purpose, the basic Bellows work units can be easily redesigned into other pieces of equipment.

Bellows Field Engineers (125 of them—one or more in every major industrial area in the United States and Canada) will be glad to work with your production people in applying Bellows "Controlled-Air-Power" to your specific needs.

Have you seen OPERATION PUSHBUTTON?

This half hour Bellows motion picture shows how all lines of industry use "Controlled-Air-Power" to lower costs. To arrange a showing, merely write on your letterhead. No cost. No obligation.

Address Dept. AM-1256
THE BELLOWS CO.
Akron 9, Ohio.

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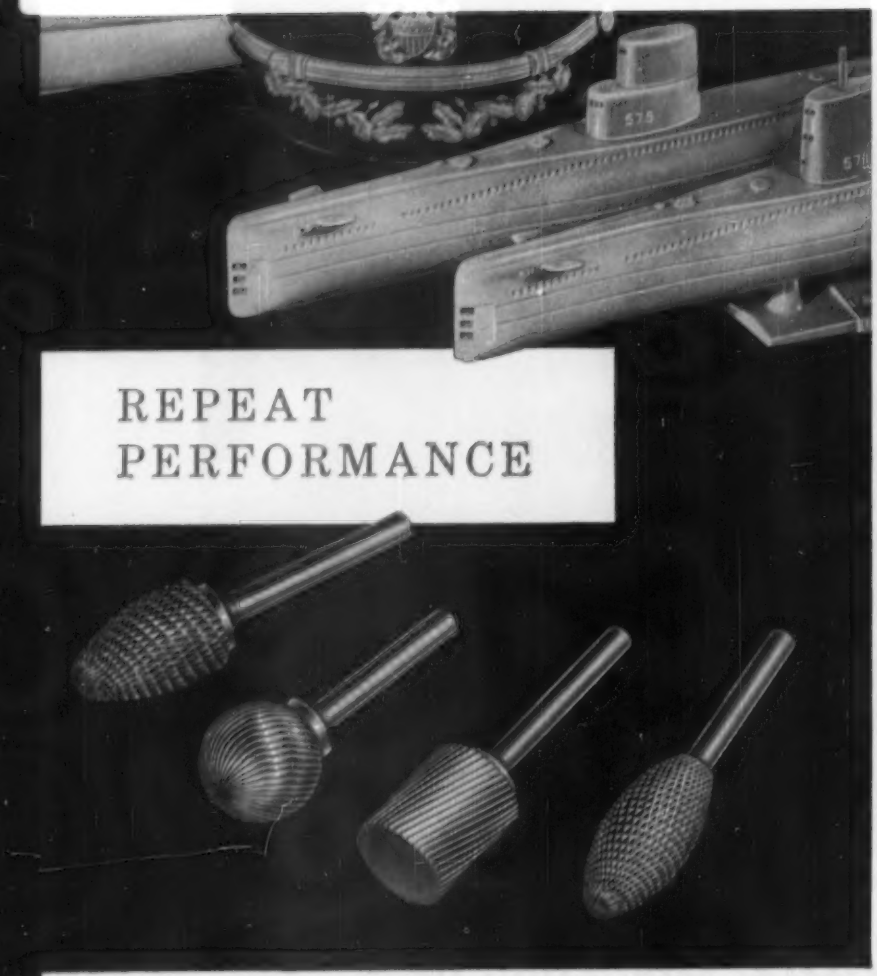
The Bellows Co.
AKRON 9, OHIO



First the Nautilus...and now the Seawolf is equipped with

PRATT & WHITNEY

KELLERFLEX

CARBIDE BURS

Star performers in any field rate encores. That's why Pratt & Whitney Kellerflex Carbide Burs . . . used throughout construction of the world's first nuclear-propelled submarine, U.S.S. Nautilus, and included in her tool kit . . . are now repeating their performance on the Seawolf.

That's typical of Kellerflex Burs, because Pratt & Whitney's master machine grinding process guarantees exact uniformity . . . bur to bur. And it takes uniformity to insure consistent, Repeat Performance.

So for Defense or Industrial usage, choose Kellerflex Burs . . . consistent performers anywhere. For complete information, write for Circular No. 564.

PRATT & WHITNEY COMPANY
INCORPORATED

11 Charter Oak Boulevard, West Hartford 1, Connecticut
Branch Offices and Stocks in Principal Cities

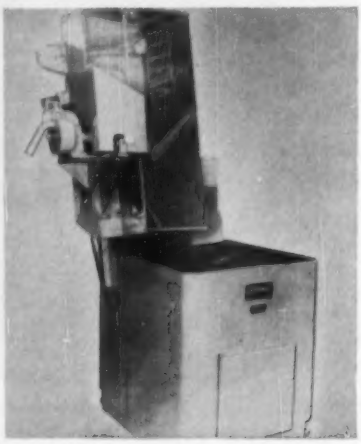
MACHINE TOOLS • GAGES • CUTTING TOOLS

NEW SHOP EQUIPMENT

ly adjusted for aluminum, stainless, and other alloys.

Adjustable feature is said to be particularly valuable in smoothing out both semi-automatic Unionmelt and open-arc steel welding; also eliminates possibility of erratic welds due to high current surges while working on difficult jobs. Line consists of 300, 500, 750, and 1200-amp machines.

Harnischfeger Corp, Welding Div, Milwaukee 1, Wis



Mechanism Feeds Trunnion Cups To Centerless Grinding Operation

Trunnion cups do not readily feed in a sliding position because diameter is larger than length. Feedall, utilizing Model 2200-B elevating hopper feeder with 4-cu-ft capacity as basic feeder, has developed a mechanism by which part is transferred from rolling position to sliding one by intermittent motion and fed into an electrically controlled gravity chute then into the grinder at a continuous rate.

Complete package consists of storage hopper, conveyor, orienting-selecting mechanism, transfer mechanism, and discharge chute. Work range for rolling parts is 3 in. in dia by 3/16 in. to 1 in. in length; for sliding parts, 3/16 to 1 in. in dia by 3 in. in length.

Feedall, Inc, Willoughby, Ohio

Carbide die drills, designed for drilling hardened die steel, are available in sizes from 1/16 to ¾ in. and in sets. Maker states that drills permit hardened parts to be economically salvaged without annealing, reworking, or rehardening. In addition, they can be used for cutting through hard outer cases and for drilling intricate

Bearings, Inc.

the foundryman's friend...through service!

Dirt... the most feared enemy of any good anti-friction bearing was damaging many bearings in the maintenance stock at the Taylor and Boggis Foundry Division of The Consolidated Iron-Steel Mfg. Co. of Cleveland, Ohio. John Cunin, Bearings, Inc. salesman, was called and within a short time, under the direction of the Taylor and Boggis Maintenance Superintendent reorganized their maintenance stocks of bearings and developed a more practical record keeping system.

First—all bearings in stock long enough to be affected by foundry dust were taken to Bearings, Inc. There, they were thoroughly cleaned, rewrapped and repackaged to be as dustproof as possible.

Second—all bearings in use in the foundry were identified by the Bearings, Inc. salesman according to the bearing manufacturers' numbers. By converting the equipment manufacturers' parts numbers to standard bearing numbers, many bearings purchased from various sources under a variety of parts numbers were found to be identical.

Weeding out these duplicates greatly reduced Taylor and Boggis purchases for inventory. Bearings, Inc. now knows what bearings the foundry uses and makes certain stocks for any emergency are carried at our branch. Taylor and Boggis now installs only factory-fresh bearings from inventory or orders from Bearings, Inc. and receives the bearings they need immediately.

Need this kind of service—service with a capital "S"? Just call our nearest branch—no obligation, of course.

Rendering bearing service in the territories adjacent to our branches, listed below.

OHIO: Canton • Columbus • Dayton • Elyria • Hamilton • Lima • Mansfield • Youngstown • Zanesville
INDIANA: Ft Wayne • Muncie • Terre Haute
PENNSYLVANIA: Erie • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Wheeling
NEW JERSEY: Camden • MARYLAND: Baltimore
Subsidiaries: Bolanrol Corp. • Buffalo, N.Y.•
Kentucky Ball and Roller Bearing Co. • Louisville, Ky.

Electrical Discharge Machining

saved $448 sinking this forging die using BRASS electrodes

Conventional Method

Mill Cavity (Man and Machine)	56 hours
Hand Finish (Experienced die sinker)	52 hours
TOTAL	108 hours

ELOX method

Forge Electrode (Man and machine)	2 hours
Set up and change electrodes (man and machine)	8 hours
Machine hours only (no operator required)	32 hours
Hand finish after E.D.M.	2 hours
TOTAL	44 hours

Saved: 64 hours at $7 per hour

additional EDM advantages in forge die machining:

- Dies are fully heat treated prior to machining thus eliminating possible distortion.
- Resizing forging dies after washout can be done within two hours.
- Inherent workhardening values are retained in the dies since no additional re-heat treating is necessary.
- Actual die life is increased.
- Many forge die alloys are self-polishing after EDM.

This machining application is one of many time and material saving jobs being turned out by the standard Elox M-500 Electronic Machine Tool. See EDM in operation at Elox Demonstration Centers.

*T.M. Reg.

elox

corporation of michigan

1828 N. Stevenson Hwy.
Royal Oak 3, Mich.

Elox Electron Drills for removing broken taps, drills, etc., from $495 to $3450.

NEW SHOP EQUIPMENT

parts in which it may be advisable to postpone drilling operations until after hardening, because of possible heat-treat distortion.

Whitman & Barnes, 40600 Plymouth Rd, Plymouth, Mich

Morton Clamping Device Reduces Set-up Time

Called Jig-Nut, clamping device is a twin-cam-activated unit that can easily be attached to any fixture-clamp stud or T-slot bolt without special fittings. Device permits operator to apply or release up to 5000 lb with a flip of the wrist.

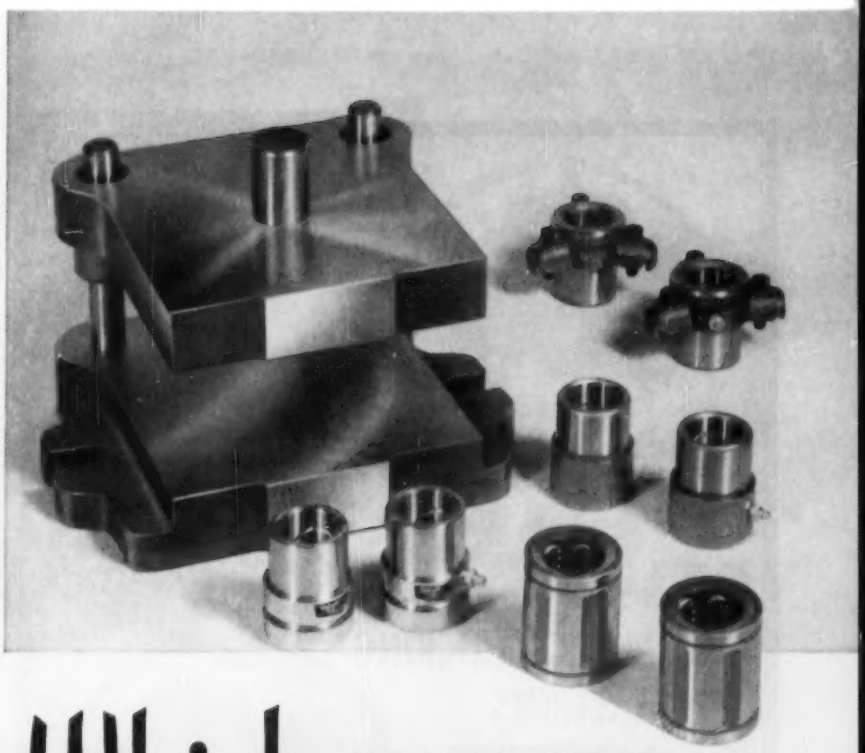
Adjustment to any desired clamping pressure is obtained by simple finger manipulation of a knurled nut.

Morton Machine Works, PO Box 231, Millersburg, Penna

Sequence Timer-Recorder for Split-Second Operation Checking

Portable instrument, called the Monitorecord, is designed for split-second monitoring of multi-operational automatic machinery.

Up to 14 operating sequences can be simultaneously timed to within one hundredth of a second and recorded on a strip chart. It can op-



Which BUSHING SHOULD YOU USE?

Your choice is getting broader every day. Each of the guide pin bushings above is good—in the right application. But, some of them cost more than others. Which should you use for best results consistent with cost?

That's where Detroit Die Set can help you. In our 25 years of exclusively building die sets, we've tested a good many types of bushings. Based upon these tests and performance in our customers' plants, we stock and recommend a number of types of bushings for use in our die sets.

To aid you in bushing selection, we've prepared a bulletin on the subject. Just ask for Bulletin 56, and we'll send your personal copy without delay. Detroit Die Set representatives also will be glad to personally aid you in selecting the right bushings and die sets. They're as near as your 'phone.

Offices in Principal Industrial Centers

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICHIGAN

GOSS & DE LEEUW
AUTOMATIC CHUCKING MACHINES
perform one to three operations in sequence or simultaneously . . .
TO CUT PRODUCTION COSTS...

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & DeLeeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.

Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.

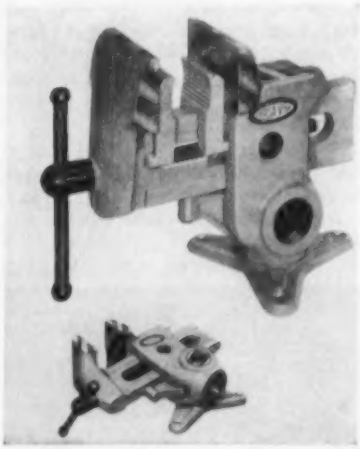
Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

NEW SHOP EQUIPMENT

erate on the electrical control circuit of any automatic machinery, transfer, assembly, and gaging and inspection equipment while machinery is running. Details in engineering data sheet No. AU-108-56.
Sheffield Corp, Dayton 1, Ohio

Electrical continuity indicator called Doylite Switcheck shows instantly the mechanical position and electrical condition of a switch. Device may be used on switches carrying up to 130 v. Its neon lamp lights when switch is open, goes out when switch is closed. Potting with an epoxy-casting resin protects components from oil, moisture, and vibration. Price is $10.95.
Doyle Design & Machine Co, 51-57 Scio St, Rochester 4, NY



VERSA-VISE turns and locks at any position, has both smooth jaws and removable serrated jaws. Dimensions: height, 8½ in.; width, 11½ in.; jaw height, 2½ in.; width, 3½ in.; opening, 5 in.; serrated jaws hold rounds up to 1½-in.-dia—*Will-Burt Co, Orrville, Ohio*

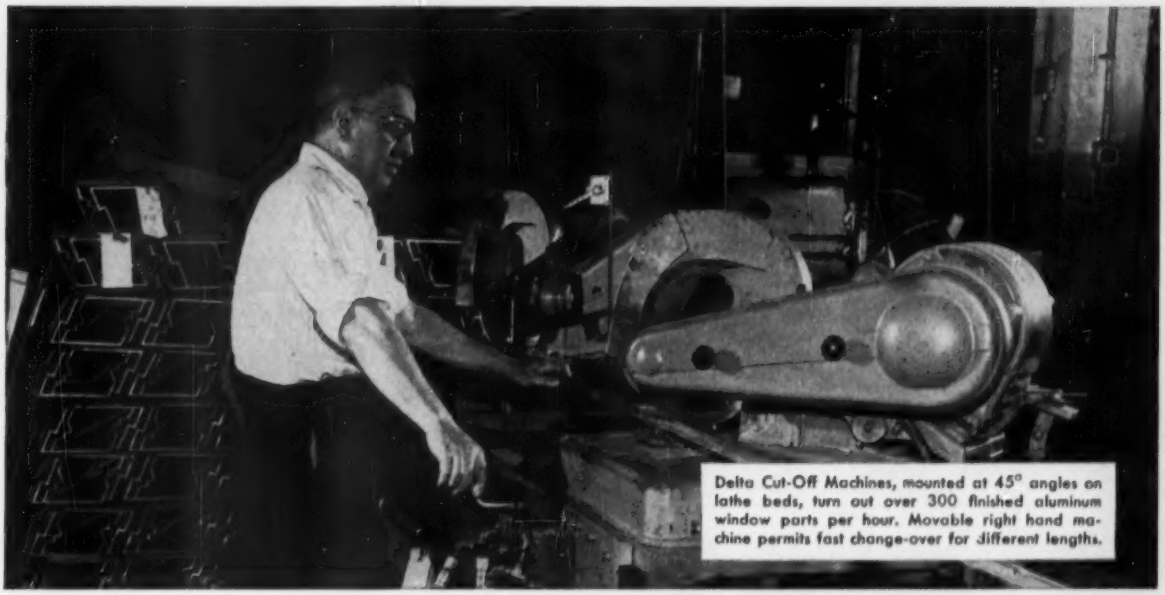
Flux kit contains sixteen of the most recently developed fluxes for electronic assemblies, printed circuits, tinning and hot-solder dipping, stainless-steel soldering, and aluminum soldering. Kit retails for $7.50.
Alpha Metals, Inc, 56 Water St, Jersey City, NJ

Electric soldering tool called Pres-To-Heat has plier-action tips which are said to heat or cool instantly by manipulation of a hand lever. Slight
(Continued on page 194)

2895 WEST GRAND BOULEVARD • DETROIT 2, MICHIGAN

ROCKWELL-BUILT

DELTA cut-off machines



Delta Cut-Off Machines, mounted at 45° angles on lathe beds, turn out over 300 finished aluminum window parts per hour. Movable right hand machine permits fast change-over for different lengths.

...save cost of expensive special equipment

for General Bronze Corp., Garden City, L.I.

DUAL SET-UPS ARE FAST, ACCURATE—By adapting versatile Delta Cut-Off Machines to handle custom operations with limited production runs, General Bronze eliminated the need for expensive special tooling. The Delta machines give them the accuracy and fast change-over needed to turn out precision work at high speed.

COST LESS TO BUY, OPERATE—Delta Cut-Off Machines not only do precision work fast, but at far less cost. "These Delta machines have been in constant use for at least 15 years," says Joseph Gafney, plant engineer, "and they consistently give us the exacting, trouble-free operation we need."

LITTLE MAINTENANCE, FAST SERVICE—According to Mr. Gafney, the little maintenance that's been needed over the years has been done quickly and easily. "Delta salesmen have given us fast, dependable service when we've needed it," says Mr. Gafney.

SEE THE ENTIRE DELTA CUT-OFF MACHINE LINE: Wet Abrasive—Dry Abrasive—Non-Ferrous Metal, Wood. Get all the facts—compare for quality, for performance. Then make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages.

Send for all the facts today!

Delta Power Tool Division, Rockwell Manufacturing Co.
618MA N. Lexington Ave., Pittsburgh 8, Pa.

- ☐ Please send catalog on entire Delta Cut-Off Machine line.
- ☐ Please send Fact Book on using Delta Power Tools teamed with machine tools.
- ☐ Please send name of my nearest Delta Dealer.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____

DELTA ROCKWELL

another product by **ROCKWELL**

"Operations Kingsbury" . . . change die castings into interchangeable pump bodies

This oil pump body starts with a die casting. The piece is not machined prior to the time it enters the Kingsbury. When it leaves the Kingsbury, it's ready for assembly.

Work is required from three general directions: the mounting surface, the cover face and the top. It was decided to perform all operations in two chuckings, passing each piece through the machine twice.

The central column machine has 18 Kingsbury units — six with auxiliary heads. Twenty work-holding fixtures are mounted in pairs on an index table which indexes through ten stations — one for loading and unloading.

Operator places the die casting in the right-hand fixture, locating the pre-formed hole (No. 10) over a spring-actuated plug. A spring loaded ram closes the fixture, locating the piece correctly.

In the first trip through the machine, 14 spindles complete six holes and mill the mounting face. This work provides an accurate surface with precise locating points for the second chucking, in which 17 spindles complete eight holes and mill and trepan the cover face.

Result . . . each milled surface is uniformly accurate in finish and angle relationship — each hole is of proper size and is located correctly. Result again . . . interchangeability, which is what was wanted, plus rapid and economical production, of course.

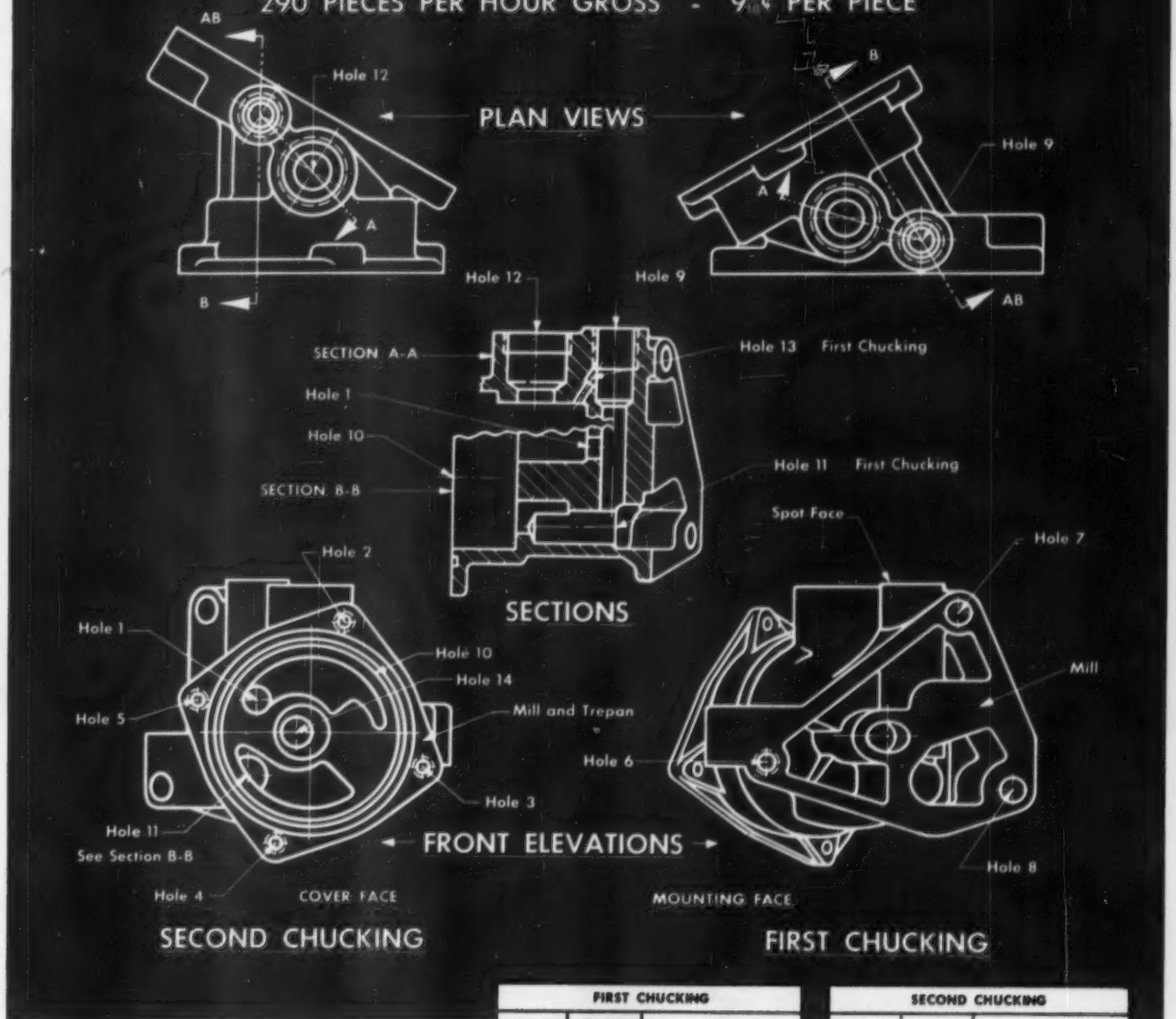
An automatic machine cannot produce uniformly accurate work unless its work-holding fixtures are *designed correctly and precision-built.* You get *both* when you get a Kingsbury.

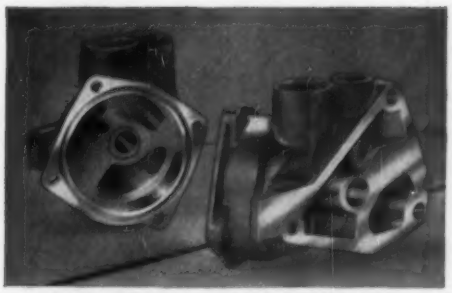
Kingsbury Machine Tool Corporation
120 Laurel Street
Keene, New Hampshire

OIL PUMP BODY - Aluminum Alloy Die Casting

32 SPINDLE OPERATIONS FROM FOUR DIRECTIONS

290 PIECES PER HOUR GROSS - 9[illegible]¢ PER PIECE



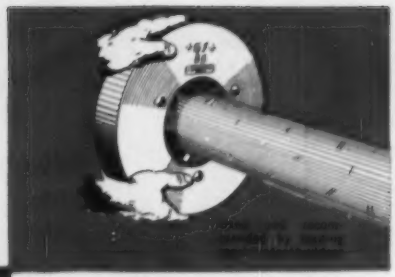


Mirror photograph shows 13 of the 14 holes, and the two surfaces — completed in two chuckings.

FIRST CHUCKING		
HOLE NO	STATION	WORK
6	1-H 4-H 8-H	Tap Drill Undersize Ream Tap
7	1-H 4-H	Drill Undersize Ream
8	1-H 4-H	Drill Undersize Ream
9	4-V 5-V 8-V 9-V	Core Drill Undersize (two dias.) Spot Face Boss Ream Tap
11	6-HR	Drill to remove Flash
13	7-AR	Drill
Mount Face	2-V	Mill

SECOND CHUCKING		
HOLE NO	STATION	WORK
1	1-H	Core Drill
2	1-H 3-H	Tap Drill Tap
3	1-H 3-H	Tap Drill Tap
4	1-H 3-H	Tap Drill Tap
5	1-H 3-H	Tap Drill Tap
10	4-H 6-H 7-H	Comb. Rough Bore* Finish Bore Finish Bore
12	7-V 8-V	Ream Tap
14	8-H 9-H	Rough Ream Finish Ream
Cover Face	2-V 4-H	Mill *Comb. Trepan

SKINNER +GF+ WORK DRIVERS



the best for turning on centers

They're fast, powerful — the ideal means for driving smooth or rough bars and forgings located on centers! Jaws are easily reversed to accommodate direction of spindle rotation. Five sizes handle work from ¼" to 8 1/16" diameter.

• ½ turn does the clamping — no wrenches needed • Each size has wide clamping range • Cuts clamping and unclamping time • Clamps out-of-round work evenly • Clamping force always matches cutting pressure.

Write Skinner or your Skinner distributor for folder.

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY
203 Edgewood Ave., New Britain, Conn.

More Production?
Specify
RUTHMAN GUSHER Coolant Pumps

Your Gusher Coolant Pump gives you instantaneous coolant flow the split second you turn on the machine. There is no priming necessary, chips cannot injure the pump. You're sure of a long trouble-free life . . . high production when you specify Gusher Coolant Pumps for your machinery. Write for our *New* Catalog.

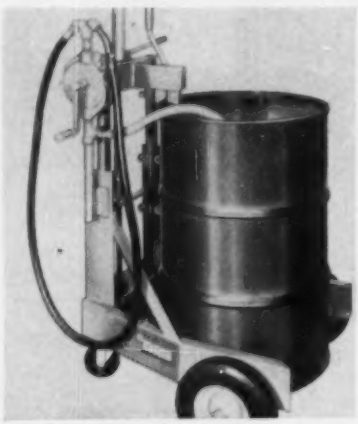
Illustrated is a Column type Avey Drilling Machine equipped with a 11020 B-Short Ruthman Gusher Coolant Pump.

THE RUTHMAN MACHINERY CO.
1818 Reading Road Cincinnati, Ohio

NEW SHOP EQUIPMENT

pressure on lever brings electrodes (jaw tips) into contact with piece to be soldered. When pressure is increased, snap switch mounted inside hand grip will operate and cause current to flow. Decrease in pressure opens switch, cutting off heat. Carbon tips on tool are standard, but special metal tips are available.

Triton Mfg Co, East Haddam, Conn



1000-lb Drum Dispenser For One-Man Operation

CeCOR Model 76 is designed to provide easy handling of drums weighing up to 1000 lb and transferral of oil and coolants directly. Adjustable clamp grips chime of standard 55 and 30 gal. open or closed end drums or those with removable head for transporting in upright position. Positive locking action permits one-man handling of open containers of liquid with no danger of spillage. Hydraulic pump and ram lifts loads to convenient height for transporting.

Model is equipped with hand-operated 10-gpm one-way pump for transferring oil coolants and solvents directly from drum to machine tool. Gallon stroke, meters, and two-way pumps as well as electrically operated units may be specified.

Coolant Equipment Corp, Verona, Wis

Ultrasonic impact-grinding service is offered for close-tolerance orifices in the hardest and most brittle materials. High precision is offered in intricate orifices, multi-drilled holes, shaping, slicing, and dicing operations; work is not chipped, spun, heated, stressed, or distorted in any way. Service employs an electromechanical transducer to convert alternating current into mechanical

stop cut it with CAPEWELL 1881

power hack saw blades

THE USER: Reisner Forge Company, South Gate, California
THE MATERIAL: Stainless Steel Billets
THE JOB: High speed production-line power hack sawing
THE PROBLEM: Blade breakage . . . too few cuts per blade
THE ANSWER: Capewell Safetech Power Hack Saw Blades
THE RESULT: Long blade life . . . blade breakage virtually eliminated.

The Reisner Forge Company chose Capewell's shatterproof Safetech Blade for this long, heavy job because they could get more cuts per blade quickly and economically under heavy feed, while providing complete operator safety. Other Capewell Power Hack Saw Blades are Technite and High Speed—each of these all-hard blades is designed to give proved maximum sawing performance.

You, too, can improve your production by standardizing on Capewell Power Hack Saw Blades. Tooth by tooth, you'll find that Capewell blades are a superior product, manufactured to rigid specifications, so that you can be assured of blades that stay sharper longer.

75 CAPEWELL ANNIVERSARY

SOLD ONLY THROUGH CAPEWELL DISTRIBUTORS who provide: complete inventory . . . engineering assistance . . . delivery when you need it.

THE CAPEWELL MANUFACTURING COMPANY
Hartford 2, Connecticut

Please send complete details on Capewell Power Hack Saw Blades to:

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

CA56A

SEND FOR YOUR NEW
Atrax "STANDARD REFERENCE"
on SOLID CARBIDE TOOLING!
We're very proud and pleased to announce the latest and largest edition ever of the Atrax Catalog is now ready for distribution.
100 colorful pages, crammed with the most complete line of precision, solid carbide tools available—and with vital, useful information on the use, care and maintenance of Solid Carbide Tools.
See hundreds of standard End Mills, Burs, Reamers, Drills, Routers, Grinding Tools and Special Solid Carbide Tools Engineered to keep your production breaking new records! A 28 page price list will be included. These two necessary references to tooling service, superiority and economy are yours by return mail—FREE!
Atrax
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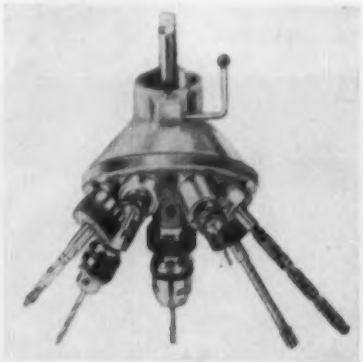
Atrax
Finish FIRST with Carbide!
THE ATRAX COMPANY
Newington 11, Connecticut

NEW SHOP EQUIPMENT

vibrations at the rate of 25,000 cps. Wide range of metallic and nonmetallic materials can be handled.
C-Mar Corp, Manasquan, NJ



Automatic Indexing Drill Head Takes 2 to 7 Tools at One Time

Jemco ARBO-2 automatic revolving and indexing multi-spindle drill head can drill or tap 2 to 7 different size holes with one chucking. Interchangeable spindles are provided with suitable Morse and Jacobs tapers, and drilling and tapping chucks; special tapers are optional. Ten independent speeds are available.

Features are: work can be completely machined with single chucking; speeds are quickly changed; no reversing of drill spindle is necessary during tapping operation; ⅛ to 9/16 tapping capacity, 0 to 19/32 drilling cap.

Jersey Manufacturing Co, 407 Livingston St, Elizabeth, NJ

Jo-El Process Welds Light-Gage Aluminum Tubing

Aluminum-tubing welding process is reported to weld any aluminum alloy at any hardness into light-gage tubing from 0.050 down to 0.025 in. Tubing is claimed to have material-strength properties superior to extruded or butt tubing.

Sample of the light-gage tubing is available on request.

Jo-El Co, 14209 Leroy Ave, Cleveland, Ohio

Weld-spatter preventative called X-7 Anti-Spatter is a silicone-containing emulsion which, applied to spatter area before arc welding, forms a protective coat over the weld metal. Invisible coat prevents molten spatter from sticking and enables operator to whisk away spatter with a

. . . engineering assistance

. . . delivery when you need it.

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

CA56A

A SHORT CUT TO A FINISHED PRODUCT

SAVE YOURSELF TIME AND TOOL CHARGES

with Anaconda multiple-plunger press products—in a wide choice of metals

If you need parts like these in quantity, The American Brass Company can save you time and money. Through its specialized experience—and thousands of stock tools—it may save tool charges, too.

Ferrules, grommets, eyelets, deep-drawn cups and shells, and thousands of other intricate, close-tolerance parts made from strip metal are everyday business. American Brass Company design engineers and toolmakers have earned an enviable reputation for cutting costs and performing the almost impossible in design and production.

Your choice of metal: Such fabricated products can be furnished in copper, brass, bronze, nickel silver, nickel, iron, steel, stainless steel, and aluminum – in a wide variety of finishes.

Standard products: For a selection of more than 1000 eyelets of common sizes and styles, as well as eyelets kept in stock for immediate shipment, write for Catalog BG-1.

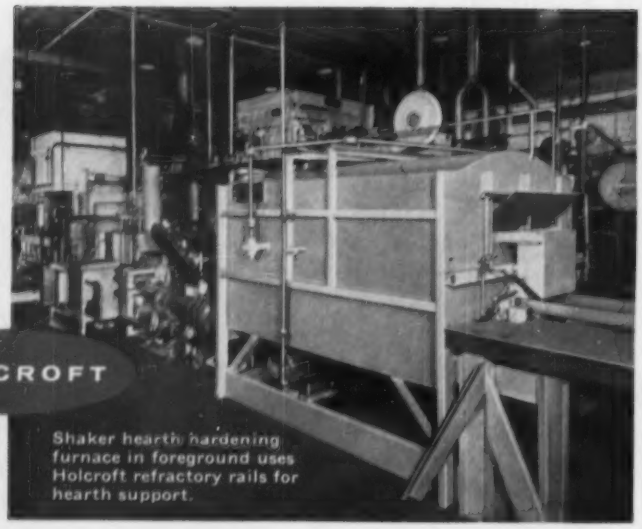
Special products: Just send a sample, drawing, or description, together with the quantity you need, the metal to be used, and other pertinent information. Address: The American Brass Company, Fabricated Metal Goods Division, Waterbury 20, Conn.

5608 (Rev.)

ANACONDA®

MULTIPLE-PLUNGER PRESS PRODUCTS

BLAZING THE HEAT TREAT TRAIL— WITH HOLCROFT



Shaker hearth hardening furnace in foreground uses Holcroft refractory rails for hearth support.

LET'S TALK ABOUT

REFRACTORY RAILS

With the current shortage of nickel, furnace manufacturers are looking for ways to replace or conserve this scarce commodity. It is interesting to note that Holcroft tackled this same problem during World War II when a nickel shortage also faced the industry.

In 1945 we designed and installed a pusher tray gas atmosphere furnace that used refractory skid rails instead of the nickel chrome alloys used at that time. Since then we have expanded their use to many other comparable applications so that now there is positive proof that properly designed installations of refractory skid rails last much longer, under similar conditions, than those made from nickel alloys. Replacements have been negligible—performance has been superior—material costs have been lower—and a marked decrease in wear on work carriers has been noted.

Yes, today a nickel shortage still exists—but Holcroft offers a job-proven answer, not only for the rails but for other vital parts of a heat treat furnace as well. You can bank on Holcroft's engineering leadership and experience—the kind that saves not only nickel—*but dollars, too!* Write for information.

HOLCROFT AND COMPANY

6545 EPWORTH BOULEVARD • DETROIT 10, MICHIGAN
PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • HARTFORD, CONN. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • PHILA., PA.
CANADA: Walker Metal Products, Ltd., Windsor, Ontario

NEW SHOP EQUIPMENT

cloth or spray after welding. Liquid is non-toxic, odorless, and non-flammable. It can be used on any metal without affecting weld quality.

Linde Air Products Co, 30 E 42nd St, New York 17, NY

Radius-Cutting Machine Features Reduced Machining Time

Radii II radius-cutting machine is reported to reduce time spent cutting radii from 30 min to a matter of seconds. Unit is designed to cut a radius on square, rectangular, flat, or round ferrous or non-ferrous metals of any size up to 1¼ in. thick by 2½ in. wide.

No set-up time is required. Operator merely inserts work into vise, sets gage to radius to be cut, adjusts slide, clamps work, and starts cutter. Chips are drawn by a blower through a hollow spindle housing and ejected through a chute into chip pan at rear of machine.

Special Machinery Co, Inc, 49 Springfield St, Chicopee, Mass

Face shields and helmets for industrial safety have a three-way adjustment said to give a perfect fit to every head shape and size. Seven headgear styles and eight window sizes are offered.

Joseph Beugeleisen Co, 21220 W 8 Mile Rd, Detroit 19, Mich

Seamless rubber belt has a straight-line cord interliner, vulcanized between two layers of synthetic rubber, that keeps the belt from stretching. Because of belt's non-stretch qualities, an unchanging length is maintained, so that its use in drives and feed belts overcomes slippage

NEW

No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

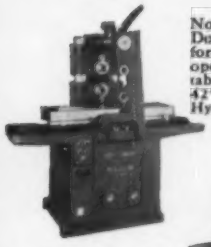
No. 3-36
HYDRAULIC MILLING MACHINE

Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for *larger size work!*

Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

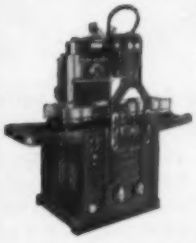
Kent-Owens Machine Co., Toledo, O.

Simple . . . Rugged . . . Efficient



No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.

No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 1-M . . . Hand feed to table and head . . . 25" x 9" table . . . 12" table travel . . . head counter-balance is adjustable.

Call on

KENT-OWENS
for MILLING MACHINES

KENT-OWENS REPRESENTATIVES

PRECISION...
UNIFORMITY...
FLEXIBILITY...

Mark 1000 or more units per hour on an infinite variety of surfaces, flat, round or curved—with absolute uniformity of depth of impression throughout longest production runs.

...PARKER #710 makes marking a production line operation

TYPICAL CASE HISTORIES

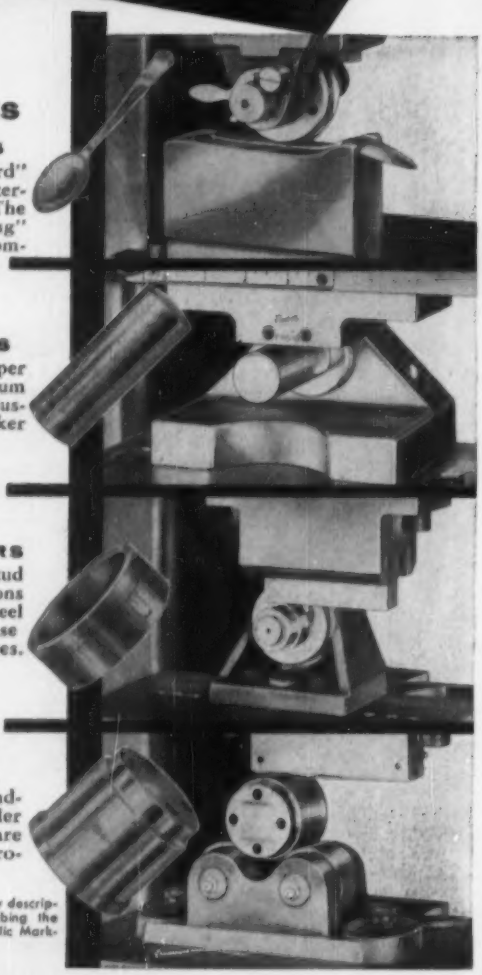
MARKING SPOONS
Using Parker #100 "standard" insert roll die holder and interchangeable segment type. The machine table's "cushioning" effect, plus proper set-up, compensated for the curvature of the spoon.

CAPACITOR SHELLS
800-1000 marked pieces per hour on thin walled aluminum shells with Parker tooling, custom built for use on the Parker #710.

GRADUATED COLLARS
Using a standard Parker stud arbor, the precision graduations were easily indented in this steel collar. Depth of mark was closely held to specified tolerances.

SOLID ROUNDS
Marking part numbers and other legends on the outer diameter of solid rounds is no problem. Standard Parker roller bearing cradles are used on this production run.

SEND TODAY for new descriptive literature describing the Parker #710 Hydraulic Marking Machine.



THE PARKER STAMP WORKS, INC.
MARKING DIE & MACHINERY DIV.
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker

problems. Belts can be made in many lengths, widths, and thicknesses, in almost any type of rubber.

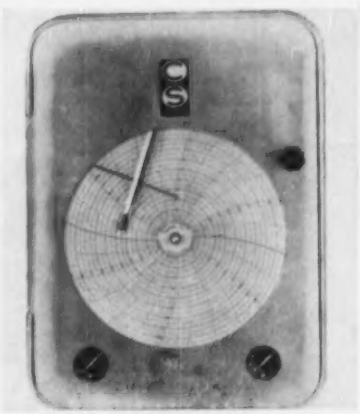
Armstrong Cork Co, Lancaster, Penna

Lightweight Lowcost Truck

Fork lift truck, Hustler 1000, weighs 2000 lb, is 68 in. long, 38 in. wide, has capacity of 1000 lb.

Battery-powered vehicle has turning radius of 56 in., reportedly 20 in. less than competitive models. Driving unit, motor, and hydraulic system are secured by bolts for simplified maintenance. Price, $3650, is said to be 25% below nearest competitor.

Hustler Corp, Willoughby, Ohio

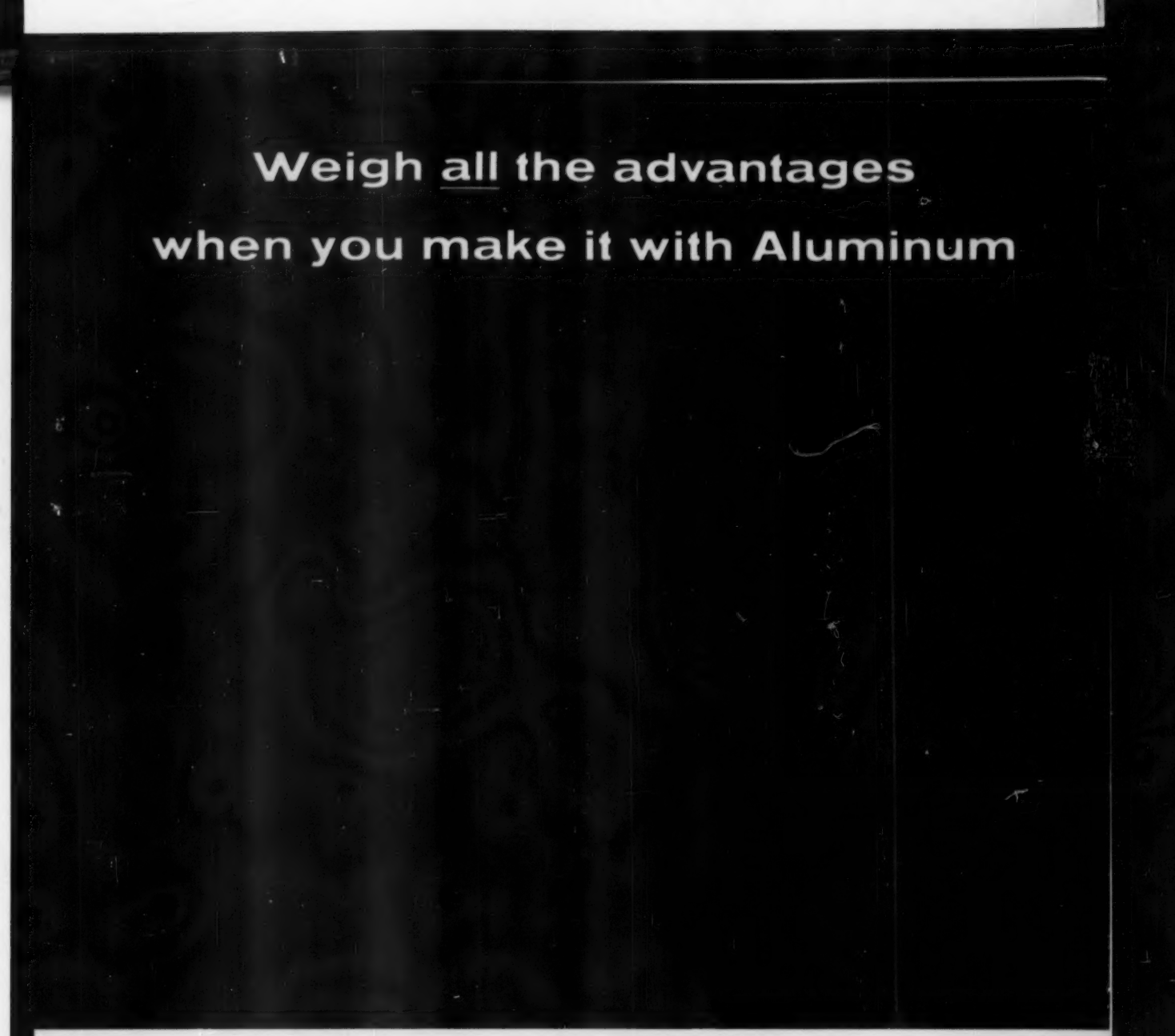


Pneumatic Recording Controller For Pressure and Temperature

Type 57 is available in models equipped with either 9 or 12-in. spring or electric-driven charts and on-off, duplex on-off, or 1-100% proportional action. Pressure ranges are from 0-5 to 0-5000 psi (0-25000 psi for 12-in. single pen only) and temperature range is from –350 to 1200 F.

Type 58 recorder, also introduced, records pressure and temperature, both in the same ranges as Type 57

Weigh all the advantages when you make it with Aluminum



You can easily adapt production equipment and procedures to forming, casting, forging, machining, welding, finishing and assembling aluminum. And when you make it with aluminum, be sure to weigh *all* of aluminum's production advantages.

Reynolds engineers and technicians know aluminum. They know standard fabrication equipment and procedures. They know production problems. But most of all they know aluminum. And they will gladly help you get full benefit from aluminum's production advantages. Aluminum's ease of fabrication which minimizes rejects and extends tool life. Its lightweight which cuts handling costs. Its high strength alloys for rugged parts. Its low cost and attractive finishing possibilities.

You can have the aluminum know-how of Reynolds engineers and technicians in book form, too. On the opposite side of this page is a complete listing of Reynolds Aluminum Handbooks, invaluable aids in getting more from aluminum.

Reynolds Engineering Service is available through the Reynolds Metals office near you, listed under "Aluminum" in your classified telephone directory, or write direct to *Reynolds Metals Company, P.O. Box 1800-JV, Louisville 1, Kentucky.*

REYNOLDS ALUMINUM
engineering service

The Finest Products Made with Aluminum

See "Circus Boy", Reynolds new dramatic series, Sundays on NBC-TV.

REYNOLDS ALUMINUM

MORE INFORMATION ON NEXT PAGE

Which of these will help you most?

A LIBRARY OF HANDBOOKS filled with important and useful information on aluminum design and fabrication. If your job is management, design or production, these books can be vital to you. Single copies of any or all of these are yours without cost when requested on your business letterhead.

ALUMINUM DATA BOOK – 160 tables give complete physical, chemical and mechanical properties; availability data, tolerances, definitions, fabrication information...220 pages.

DESIGNING WITH ALUMINUM EXTRUSIONS – Explains the basic principles for using extruded aluminum shapes most effectively . . . 138 pages.

ALUMINUM STRUCTURAL DESIGN – Shows how to design original structures with aluminum or convert present designs to aluminum . . . 130 pages.

ALUMINUM FORMING – Presents accepted practices for bending, forming and drawing aluminum . . . 152 pages.

CASTING ALUMINUM – Discusses casting design, methods and procedures, alloys, heat treating, machining and finishing . . . 130 pages.

FASTENING METHODS FOR ALUMINUM – Offers information on mechanical joining and fastening methods, and the advantages of each . . . 136 pages.

FINISHES FOR ALUMINUM – Gives basic data on application and uses for electroplated, mechanical, chemical and organic finishes . . . 124 pages.

MACHINING ALUMINUM ALLOYS – Covers aluminum machining including automatic screw machining . . . 124 pages.

HEAT TREATING ALUMINUM ALLOYS – Explains the theory and procedures for heat treating aluminum alloys . . . 119 pages.

WELDING ALUMINUM – Gives complete data on the welding, brazing and soldering of aluminum . . . 186 pages.

ALUMINUM POWDERS AND PASTES – Describes types of powders and their uses in paints and coatings, pyrotechnics, processing, metallurgy and other applications . . . 84 pages.

16mm Sound-Color Films Available, too

1. **SHAPE OF THINGS TO COME** (extrusion design and application)
2. **THE BENSON BARREL** (drawing and welding operations on aluminum barrel. Black and white film.)
3. **TALE OF THE POWDERED PIG** (powders and pastes and their uses)
4. **ALUMINUM ON THE MARCH** (aluminum from mine to finished products)
5. **THE CHEMISTRY OF ALUMINUM** (chemical aspects of aluminum production from bauxite mining to metallic aluminum)

A COMPLETE INDEX

of all Reynolds Technical Literature and Films on aluminum design and fabrication is also available. Write to Reynolds Metals Company, P.O. Box 1800-JV, Louisville 1, Kentucky.

Instructors in technical schools are also invited to take advantage of these educational aids. Write for details.

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

recording controller. Models are furnished with either 6, 9, or 12-in. charts, are either spring-wound or electric driven, and have from one to four recording pens.

A W Cash Co, PO Box 551, Decatur, Ill

Measuring and Recording Gage Checks Strip Stock

Model 493 B-139 gage is mounted in a wheeled cabinet and is placed between a feed roll and a punchpress, so that strip stock goes through the gage before it reaches the press. By checking the stock continuously and observing the gage meter hand or the recorder, operator can check the thickness trend of the stock. Response of gage is deliberately dampened so that local irregularities will not show and so that the gage will see an average stock thickness.

Unit is adjustable to measure stock from 0.015 to 0.100 in. thick and from 5 to 18 in. wide. It is made up of stock components for quick assembly and reasonable cost.

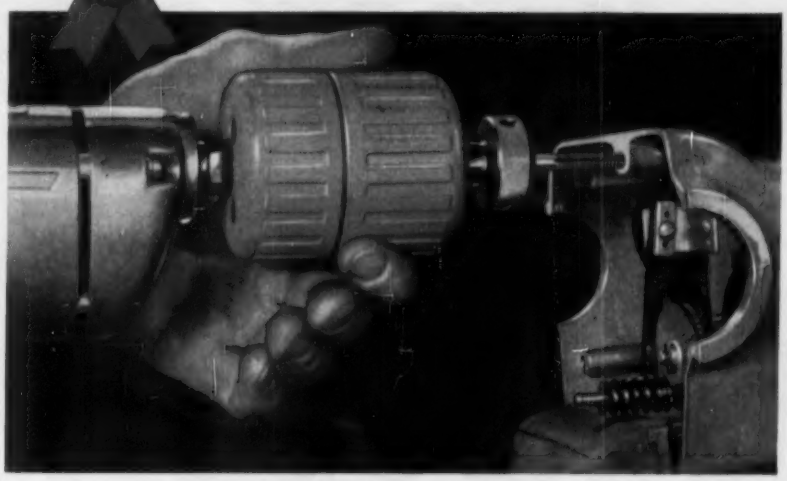
Federal Products Corp, 1144 Eddy St, Providence 1, RI

Flexible drill shaft increases usefulness of portable electric drill. Shaft consists of a ¼-in. tight-wound, high-carbon core covered with a flexible rubber-covered casing. It is hooked up by inserting the ¼-in. shank at one end into the drill chuck. Different-style 45 and 90° angle heads can be provided.

Stow Mfg Co, 29 Shear St, Binghamton, NY

Magnetic disk brake in Series 70 is designed for application on electric motors used in atmosphere where

WINNER! MILL & FACTORY'S "FEATURE PRODUCT AWARD" OCTOBER, 1956



SUPREME

Push-Pull Tapper

New Power Drill Attachment Taps to Highest Standards . . . Cuts Breakage . . . Lowers Costs

Mill & Factory Magazine's Board of Review has designated Supreme's new Push-Pull Tapper as winner of their "Feature Product Award" for October. This Board is composed of a group of engineers, editors and production experts who each month study hundreds of new items that are being offered to industry for the first time. They select the one product they feel is the most needed by all industry.

The Supreme PUSH-PULL TAPPER is an instant-reversing speed reduction unit made expressly for tapping. It attaches easily to either the spindle or chuck of any portable drill. Detachment after use is equally simple. The speed reduction of 7:1 gives more than adequate power to tap in all materials, and the instant-reversing means that the direction of the tap can be reversed without stopping the drill motor. Thus the tap can be moved into and out of the hole at will.

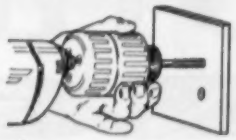
Reduces Tap Breakage

Tap breakage is held to minimum when the PUSH-PULL TAPPER is used, because the operator has a better "feel" for his work. When in use the TAPPER housing is held in the finger-tips, and any unusual strain is felt immediately. Releasing the fingers stops the tap instantly.

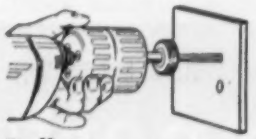
Handles Taps Up to 5/16" Dia.

The complete PUSH-PULL TAPPER Kit, No. 9000, costs just $29.95; includes everything except taps. Order from your Industrial Distributor.

HOW IT WORKS:



Push and the tap runs in smoothly . . .



Pull and it comes out easily . . .

That's all you do—Push-Pull

By the makers of famous SUPREME brand CHUCKS

SUPREME PRODUCTS CORPORATION

2222 SOUTH CALUMET AVENUE, CHICAGO 16, ILLINOIS

Chicago-Latrobe Drills

HIGH SPEED AND CARBIDE

MORE AND MORE THE experts choice

Standardization on Chicago-Latrobe High Speed and Carbide Drills is becoming commonplace with production experts. Reason? Better production results . . . less down time . . . fewer re-grinds. Another reason? Chicago-Latrobe distributors carry the most complete stock and consequently offer unexcelled service. Order Chicago-Latrobe next time—specify "no substitute."

DOUBLE CIRCLE TOOLS

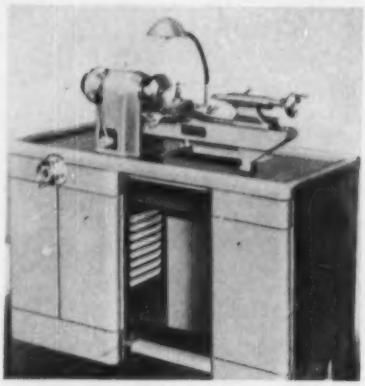
Chicago-Latrobe

416 WEST ONTARIO STREET • CHICAGO 10

• DRILLS • COUNTERSINKS • CARBIDE TOOLS
• REAMERS • COUNTERBORES • SPECIAL TOOLS

combustible dust creates a hazard. Brake is designated "dust-ignition-proof" for use in Class II, Groups E, F, and G hazardous locations as defined by the National Electrical Code. Unit is offered with maximum torque ratings of 10, 25, 50, and 75 lb-ft, for floor or motor mounting.

Stearns Electric Corp, Milwaukee, Wis



Wade Bench Lathe Has 1-in. Collet Capacity

No. 73 precision bench lathe is built with a hardened and ground bed, totally enclosed headstock of 1-in. collet capacity, and 7-in. swing. Headstock spindle is equipped with preloaded anti-friction staggered cylindrical roller and ball bearings.

Standard equipment consists of draw-in bar, offset tailstock with hardened and ground full-bearing spindle, hand rest, dogface plate, centers, and center collet. Unit comes equipped with compound slide rest and with large-diameter acme threads in long bronze nuts. Micrometer dials are graduated in thousandths of an inch.

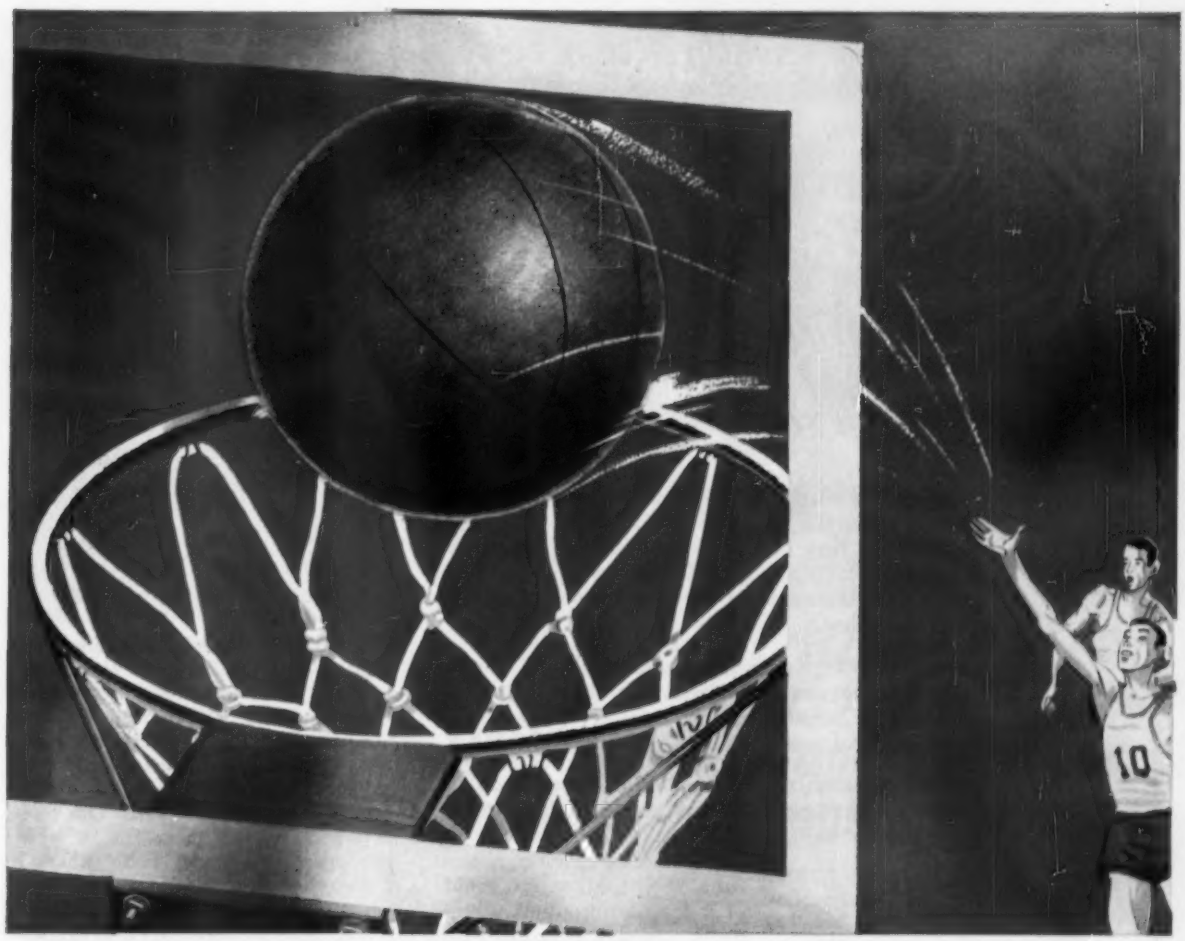
Variable-speed drive gives an infinite range of spindle speeds from 100 to 3500 rpm. Lathe has a single lever for stopping and starting the headstock spindle. A mechanical reverse gives a high-low spindle-speed ratio of 5 to 1. Descriptive circular is available.

Wade Tool Co, Waltham, Mass

Aluminum Oxide Abrasive

Abrasive, called 44 Alundum, is produced by a special new electric furnace process.

Ability to hold form and remain sharp between dressings makes the abrasive particularly adaptable to applications such as ball bearing grinding; honing sticks; centerless, cylindrical, and internal precision



"Finish first in your league"

...with J&L COLD FINISHED LEADED STEELS

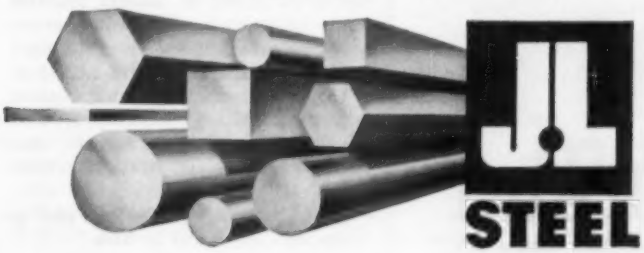
These modern, superior J&L Leaded free-machining cold finished steels are meeting with outstanding acceptance in machine shops everywhere. They are a star member of the complete line of premium quality, free-cutting cold finished bar steels produced over the years by J&L specialists. Thus, we can recommend the right type to help solve your particular machining problems.

Available in *both Bessemer and Open Hearth grades*, J&L Leaded steels offer:

- **SUPERB MACHINABILITY**—because they enable you to use optimum cutting speeds, to secure longer tool life and to produce superior surface finishes.
- **GREATER UNIFORMITY**—because they are completely J&L-produced from the basic raw materials to guarantee optimum uniformity which is so necessary for modern industry's high-speed machining operations.
- **HIGHEST QUALITY**—because they must meet the rigid quality standards developed by J&L through years of leadership in the development and production of free-cutting steels.

Adequate stocks of all J&L cold finished free-machining steels are available in important industrial centers. Phone the nearest J&L District Office or your Distributor for prompt and efficient service.

Pick the Free-Machining Steel that serves you best—from J&L's complete Cold Finished Line



Jones & Laughlin
STEEL CORPORATION · PITTSBURGH

COLD FINISHING PLANTS AT
PITTSBURGH, PA., AND HAMMOND, IND.

AIRengineering at work
REPORT No. 5098B-3

Multiple Screw Driver assembles 400 carburetors per hour

Assembling carburetors was a slow, one-screw-at-a-time operation until AIR engineering solved the bottleneck. Now one operator uses this 8-spindle automatic Multiple Screw Driver to help turn out more than 6 completed carburetors per minute—400 every hour.

This compact, easy-to-operate Multiple Screw Driver is just one more example of how AIR engineering is helping modern industry solve problems and cut production time and costs.

All the experience of Ingersoll-Rand in speeding up fastening through AIR engineering multiple units is yours for the asking. Whether your operations involve screw-driving or nut running with either hand-held or automatic production line units, Ingersoll-Rand can engineer and build just the unit best suited to your needs.

8-Spindle Multiple Screw Driver for carburetor assembly.

Drop us a line if you'd like an AIR engineer to analyze and make recommendations on your fastening operations.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

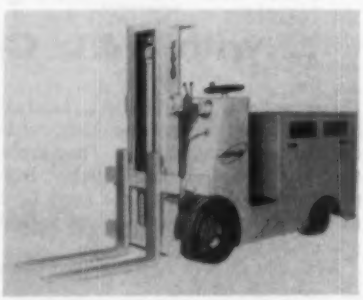
8-341

NEW SHOP EQUIPMENT

grinding; saw gumming; snagging; thread grinding; mounted wheels, and disk wheels.

Norton Co, Worcester 6, Mass

SPRAY GUN, Model 21, features dual-purpose air valve which permits use of air from horn holes only or center air-cap holes only or an intermixture of air from these sources. Atomizing air control and fan control afford infinite pattern adjustment with a minimum number of air caps. One-piece forged shell is aluminum with an anodized aluminum finish which is chrome-plated. All internal metal parts are stainless steel—*Paasche Airbrush Co, 1909 W Diversey Parkway, Chicago 14, Ill*



Elwell-Parker Fork Truck Offered in Stand-Up Version

Electric-powered, stand-up fork truck, designated R10T, has a capacity of 10,000 lb. Model features front wheel drive, rear wheel steer, and has a travel speed of 4.5 mph without load, 4 mph with full load.

Other features: contactor control with automatic acceleration, four speeds forward and reverse, and heavy-gage, welded-steel box structure.

Elwell-Parker Electric Co, 4205 St Clair Ave, Cleveland 3, Ohio

NEW SHOP EQUIPMENT

TORQUE-WRENCH CALIBRATOR for hand torque wrenches is a self-contained unit which requires no piping, wiring, or other external connections. It is certified to be accurate within 1% of full-scale reading, and may be used to check both right- and left-hand wrenches of flash, snap, or dial type. The hydraulic instrument is offered in models which can check torques ranging from a few in.-lb to 2000 ft-lb. Unit illustrated checks torque from 0 to 30 ft-lb, weighs 6 lb, and is 7½ in. high—*Skidmore-Wilhelm Mfg Co, 442 Green Rd, Cleveland 21, Ohio*

Hydraulic Elevating Table Is Foot-Actuated, Portable

Hydraulic foot control lever raises table to desired height, foot release valve lowers it. Unit moves on roller bearing casters with ball bearing swivels. Top rotates 360°, clamps quickly in any position.

Carrying capacity is 2000 lb; max table height from floor (raised) is 46½ in., minimum (lowered), 31 in., table size is 24 x 30 in.

Midwest Tool & Engineering Co, 114 Webster St, Dayton, Ohio

Torque control IMPACTOOL

NEW accuracy and speed for precision nut running jobs . . .

- **POSITIVE TORQUE CONTROL**—a revolutionary use of a rugged steel torsion bar for precision control of torque—combined with the power and speed of the Impactool.
- **SIMPLE TORQUE SETTING**—torsion bar adjusting sleeve is clearly calibrated for changing torque with easy-to-use torque jig.
- **TORQUE SETTING REMAINS CONSTANT**—for any nut running condition until the adjustment is changed.
- **ELIMINATES "OVER-TORQUE"**—impact mechanism rebounds instantly when preset torque is reached, tripping a foolproof rubber faced shutoff valve.
- **LOW MAINTENANCE**—combines many of the proven features of Ingersoll-Rand Impactools, with their enviable record of dependable performance and low maintenance.
- **REVERSIBLE**—full power in either direction.
- **NO CLUTCH**—to wear, slip or require adjustments.

* **2 TORSION BARS PROVIDE MULTIPLE TORQUE SETTINGS**

- No. L735 Max. torque 60 ft. lbs.
- No. H735 Max. torque 90 ft. lbs.

For torques up to 550 ft. lbs. a Size 5340T Torque Control Impactool is available.

Get a free demonstration of Ingersoll-Rand Torque Control Impactools by an I-R AIR engineer now... or write for additional information.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

8-342

57 VARIETIES boiled down

L. A. Edwards

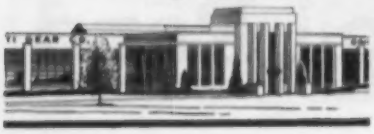
ASST. SALES MGR., THE CINCINNATI GEAR CO.

We could pass ourselves off as the Heinz of the Gear Industry by naming at least 57 different varieties of gears that we manufacture — but to be more concise, the gears we produce can be listed in eleven *basic* categories: spur, helical, rack, worm, herringbone, bevel, spiral bevel, internal, sprocket, Zerol® and Coniflex® (®Reg. U.S. Pat. Off.). This is still a pretty impressive list, we think, and covers just about all types in current demand for industrial use. Of course there are many variations within these basic types, too — such as a hypoid gear, which is basically a spiral bevel gear.

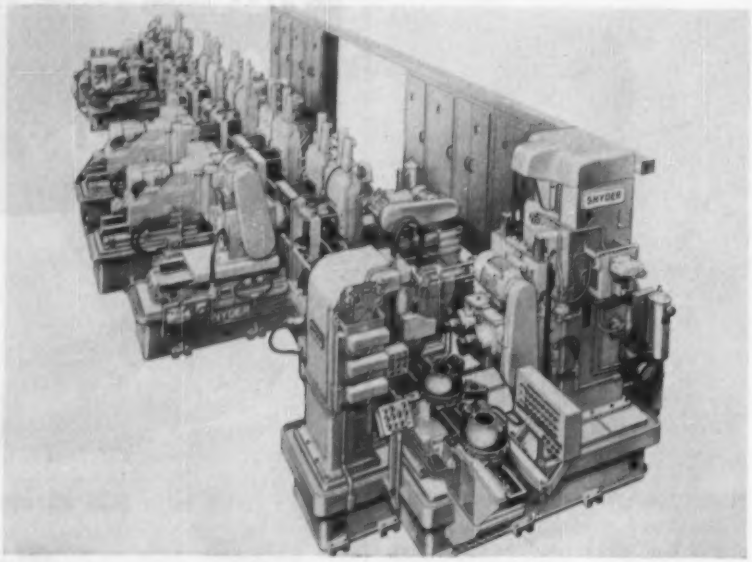
If you're one who has always thought that "gears is just gears," it will pay you to find out just what advantages each of these types has to offer. For instance, a straight bevel gear might perform *adequately* in an application that *ideally* calls for a Zerol gear; but fine points such as this can make the difference between *adequate* and *superior* results from your product. Your Cincinnati Gear Representative can cite advantages for the different gear types, and perhaps give you some ideas for applications in your products that you may have overlooked. And after the "right" gear has been chosen for your application, we can produce it for you — not only the right *kind* of gear, but with the "right" *quality* and *service* to assure your becoming another of our many satisfied repeat-order customers.

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
"Gears—Good Gears Only"

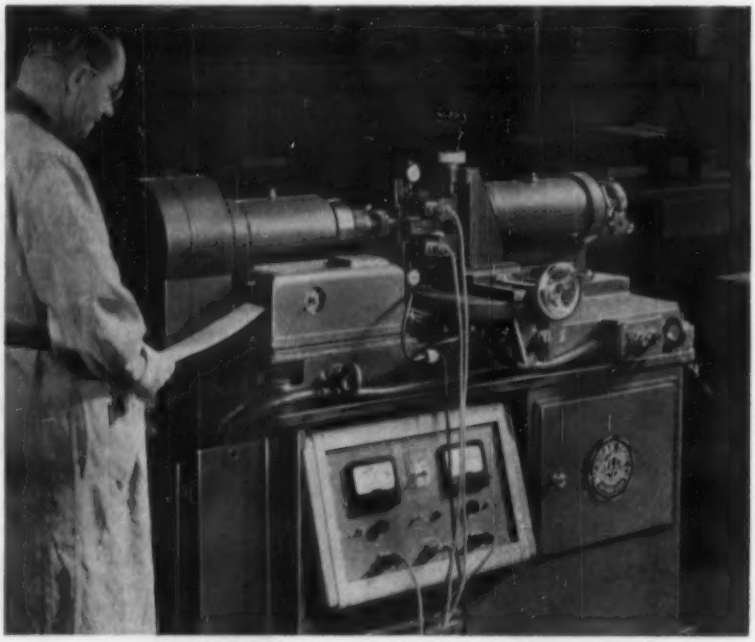
CINTI®



NEW SHOP EQUIPMENT



AUTOMOTIVE CONVERTER HOUSINGS are processed at the rate of 128 per hr on 24-station, 55-ft-long transfer machine made up of 9 in-line segments. Work is not clamped in pallets or fixtures during the cycle; instead, three target pads are milled on the side of the part, which is then tipped up and located on the pads throughout the transfer from one station to another. Elimination of pallets means less space requirements, no chip-cleanoff problems, and no distortion due to release of clamping forces. Operations include drilling, boring, chamfering, and tapping—*Snyder Tool & Engineering Co, 3400 E Lafayette, Detroit 7, Mich*



AUTOMATIC GEAR CHECKER, Model 481, can be used to inspect precision spur gears ranging from ¼- to 2¾-in. face width and from ½- to 14-in. dia. Unit checks for parallelism and tooth spacing and provides a permanent record on the recorder chart. Tooth is checked in approx 5 sec. Inspector loads gear and depresses start button; remainder of cycle is automatic—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich*

McKay

High Production Draw Benches

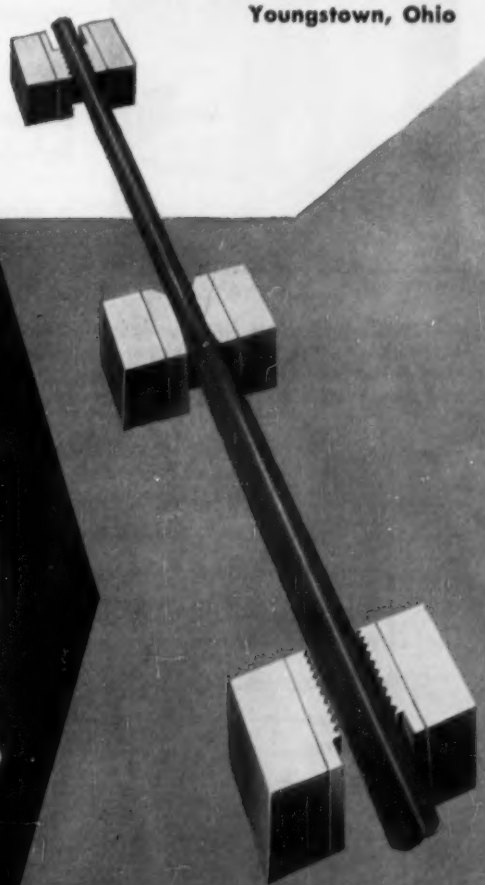
Here's greater cold draw production at a substantially reduced cost! McKay's line of rugged, precision built equipment is designed to meet and exceed today's accelerated demands.

FOR EXAMPLE; Integral, centerline push pointing provides smooth flow and eliminates a costly operation. Die blocks and pusher blocks are retained in machined ways, eliminating bolts and facilitating change over. Carriage return speeds are stepped up, allowing more productive time in the draw cycle. Automated lines are possible merely by addition of standard units already proved and in operation.

You'll profit by calling a McKay sales engineer.

THE McKAY MACHINE COMPANY

Youngstown, Ohio



10035

Mc K

SETTING THE STANDARDS OF QUALITY METAL WORKING MACHINES FOR TWO GENERATIONS

WHY MONARCH lathe head stocks are MICROHONED

Monarch Machine Tool Company Microhones the spindle bores in its lathe head stocks because Microhoning . . . generates consistent finish, size, and alignment of bores . . . corrects out-of-roundness . . . eliminates cost of line-reaming operations . . . permits interchangeability of spindles and bearings.

And with the use of a new three-diameter Microhoning tool, honing time is reduced approximately 40% over former method which employed two double-diameter tools. One set-up now replaces multiple set-ups previously required.

APPLICATION DATA:

STOCK REMOVAL
.003" to .004"

TOLERANCES
diameter..... .0002"
roundness..... .0001"
taper..... .0001"

FINISH....20-25 microinches

PREVIOUS OPERATION
line boring

3 IN-LINE BORE SIZES
4.125" dia. x 1.500" long
5.118" dia. x 1.250" long
6.299" dia. x 5.125" long

Micromatic tooling for Microhoning applications is constantly furnishing manufacturers with cost reductions, higher production and better functional characteristics. A Micromatic Field Engineer will be glad to discuss your production problems and show you "Why" the proper Microhoning tools will help.

The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ C

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NEW SHOP EQUIPMENT

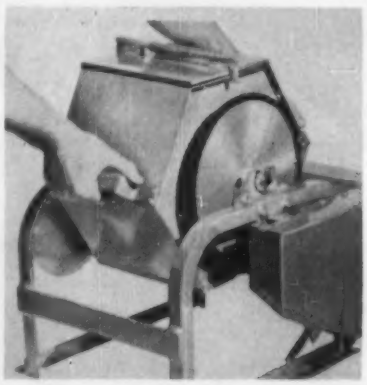
Lapping-machine stand which is 36 in. wide, 32 in. high, and 24 in. deep is available for use with company's Model 12 Lapmaster. Sides of stand are of 12-gage steel, top of ¼-in. steel plate. Lapping machine is placed on top of table, storage space is provided underneath. Stand weight is 200 lb.

Crane Packing Co, Dept AMN, 6400 Oakton St, Morton Grove, Ill

Flexible-arm shield called Magic Eye is suited for use on machines where a mounting location is not available close to the work. Unit is secured to machine by Alnico-V permanent-magnet base, has 12-in.-long arm. The transparent shield is of 10 x 12-in. size.

Unit is also available with a permanent mounting fixture in place of the magnet base.

Standard Portable Cord Co, Inc, Mayville, N Y



HANDEE SLIDE-ABRADER for deburring and finishing small parts is portable unit with three-speed drive, and automatic timer. Novaculite, as well as all conventional types of tumbling media and compounds can be used—*Chicago Wheel & Manufacturing Co, 1101 W Monroe St, Chicago*

Centerless-unit cloth buff is composed of several sections, each double-sewn for strength, locked together in advance and mounted on a hollow, flanged shaft. Slipping the complete buffing head on or off the machine takes only a few seconds. An almost unlimited number of sections can be locked together to build a buffing face up to 12 in. or wider. Buffs are offered in a wide range of densities and sizes.

American Buff Co, 2414 S LaSalle St, Chicago 16, Ill

Free Literature

To order any of these bulletins, please use cards at start of this section—page 168c.

MACHINES AND ATTACHMENTS

34 HYDRAULIC POWDER METAL PRESS—*Watson-Stillman Press Div, Farrel-Birmingham Co, 301 Aldene Rd, Roselle, NJ.* 4-page bulletin 380 illustrates features and describes operation of Model 6-125 for producing parts of complicated shape. Unit has 125-ton capacity, 6-in. max stroke.

35 "DIE CASTING WITH ZINC ALLOYS"—*Henning Bros & Smith Inc, 91-127 Scott Ave, Brooklyn 37, NY.* 31-page booklet contains specific operating details on requirements of alloys which affect mechanical and physical properties of casting produced. Production factors discussed.

36 CONTROL TRANSFORMER LINE—*General Electric Co, Schenectady 5, NY.* 32-page bulletin gives voltage ratings, frequency, frame size, application, price and specification data on autotransformers, control panel, and machine-tool transformers.

37 HYDRAULIC MARKING MACHINE—*Parker Stamp Works, Franklin Ave, Hartford, Conn.* 4-page illustrated folder describes Model 710 for production line marking of flat, round, or curved surfaces. Case histories and specifications included.

38 20-IN. DRILLPRESS—*Delta Power Tool Div, Rockwell Manufacturing Co, 465 Lexington Ave, Pittsburgh 8, Penna.* 4-page bulletin AD-1011 contains description, specifications, special features; tabular data on speeds, feeds, capacities. 28 models, bench, floor, and overhead with single or multiple spindles, hand or power feed.

TOOLS AND ACCESSORIES

39 DIAL SNAP GAGES—*Standard Gage Co, Poughkeepsie, NY.* 8-page bulletin gives illustrated descriptions of gages incorporating Paralloc mechanism for maintaining parallelism of anvil faces, and the Dializer, an indicating unit which can be used for converting an AGD adjustable limit snap gage to a dial snap gage.

40 CUTTING OIL & GREASES—*Sun Oil Co, 1608 Walnut St, Philadelphia 3, Penna.* Bulletin 48 lists advantages and applications of Sunicut 85, a transparent heavy-duty cutting oil especially recommended for production threading of high-alloy steel tubing. Bulletin 49 gives details on two water-resistant extreme pressure greases developed for shock-loaded bearings. Bulletin 50 covers new line of premium greases, Sun Prestige 40 Series, designed for use where water, high temperatures, or both, would make ordinary greases inadequate.

41 SHEET STEEL SEPARATORS—*E V Nielsen, Inc, 129 Broad St, Stamford, Conn.* 4-page catalog B1056 gives data on Basco permanent magnet units available in 23 models for handling materials up to ¼-in. plate. Operating instructions, specifications, performance charts included.

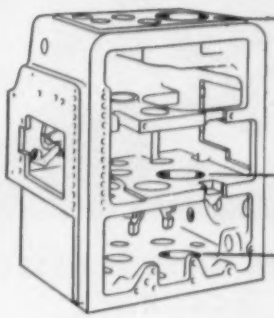
42 UCON HYDROLUBES—*Carbide & Carbon Chemicals Co, 30 E 42 St, New York 17, NY.* 16-page booklet F-40134 describes new CP fire-resistant hydraulic fluids; gives physical properties; discusses advantages and limitations of water-base products; contains data on installation, use, and maintenance.

43 JEWELERS LATHE ACCESSORIES—*Louis Levin & Son, 3610 S Broadway, Los Angeles 7, Calif.* 6-page bulletin R contains illustrated description of full

HOW with one set-up MONARCH MICROHONES three bore diameters

Using a three-diameter tool and only one set-up, Monarch Machine Tool Company Microhones three in-line bores in lathe head stocks. Bore diameters are 4.125″, 5.118″ and 6.299″. Stroke of Microhoning tool is changed only once during the working of all three bores. Former method of honing required multiple tooling and set-up.

How Monarch Microhones:



BORE "C"
6.299″ Dia. x 5.125″ Long

BORE "B"
5.118″ Dia. x 1.250″ Long

BORE "A"
4.125″ Dia. x 1.50″ Long

FIRST STROKE SETTING	Bore "A" is Microhoned while guiding on Bore "B" Bore "B" is Microhoned while guiding on Bore "A"
SECOND STROKE SETTING	Bore "C" is Microhoned while guiding on Bore "B"

How This Microhone Tool Operates:

A compound cone in the tool allows any one of the three bores to be Microhoned by expanding or collapsing individual banks of stones and guides. A selector sleeve shifts the cone rod to provide positive control of abrasives and guides.

Micromatic "How" knowledge, obtained through 27 years of experience in designing, engineering and manufacturing of Microhoning equipment for all types of applications throughout the world, can solve your production honing problems.

Learn how Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____

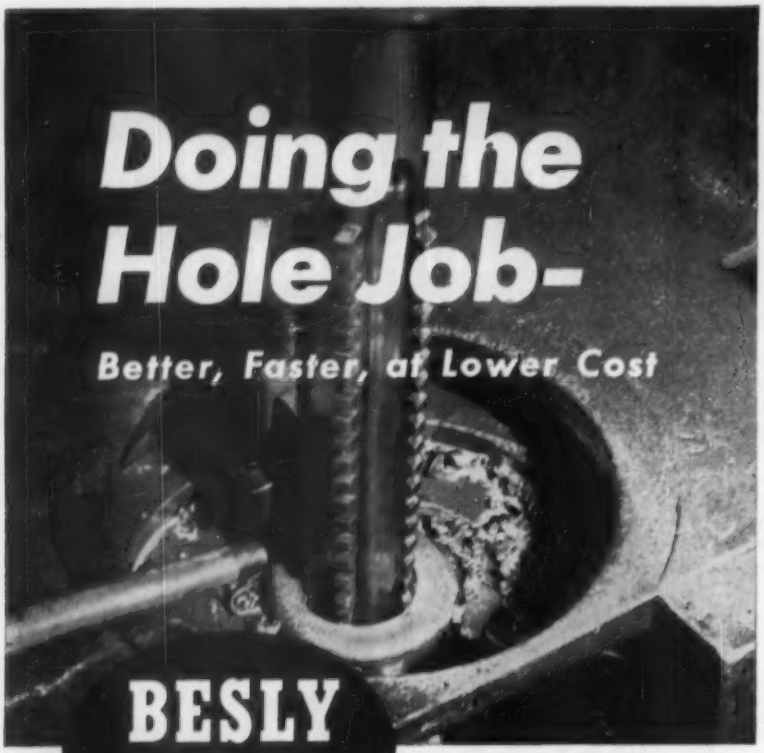
TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____ C

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN



with UNSURPASSED ACCURACY at all vital points

● LET US PROVE that Besly can help you get better threaded parts, longer tap life and lower tapping costs. Ask your authorized Besly Distributor for a TRIAL RUN on your toughest jobs . . . PLUS details on Besly's Super-Service on "Specials".

Tru-Square DRIVER

Mirror-Finish FLUTES

Solid Ground THREAD FORM

Accurate RAKE ANGLE

Microcentric CHAMFER

BESLY

BESLY-WELLES CORPORATION
Established as C. H. Besly & Co. in 1875
120 Dearborn Avenue • South Beloit, Illinois

Free Literature

line of turret tools including releasing tap and die holders with shock-free clutches, releasing tap holders, die holders, and ball bearing centers for use in lathe tailstock, and line of precision collets.

44 MINIATURE SHIELDED THERMOCOUPLES—*Thermo Electric Co, Saddle Brook, NJ.* Illustrated bulletin contains information on applications; calibrations, temperature ranges, materials of construction, and immersion lengths in which they are available; special section on terminals and quick-coupling connectors.

45 SPEED RECORDERS — *Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Penna.* Illustrated data sheet ND46-27(100) describes electronic Speedomax H indicators and recorders for precise measurement of rotational or linear speeds, and tachometer generators used with them. Lists features and specifications, tabulates characteristics and speed ranges of standard and explosion-resistant tachometers.

HEAT TREATING AND WELDING

46 WELDING POSITIONER—*Worthington Corp, Plainfield, NJ.* Bulletin R-1700-8-18 P covers Model 5P for automatic and manual welding. Unit is completely power-operated for both tilt and rotation. Features and applications pictured. Bulletin R-1700-8-19 P illustrates and describes new head and tailstocks for welding and assembly.

47 STUD WELDING—*K S M Products, Inc, Merchantville 8, NJ.* 36-page booklet on industry standards in arc welding studs, pins, and tapped pads. Each specification page lists size minimums and maximums. Covers mechanical properties, chemistry, thread sizes, plating and annealing information.

48 HEAT TREATING BERYLLIUM COPPER—*Penn Precision Products, 501 Crescent Ave, Reading, Penna.* 4-page bulletin 8 presents new recommendations to produce max strength and hardness in beryllium copper strip. Hardness-response curves given in detail, as well as specification properties for Alloys 25 and 165.

PLANT SERVICE EQUIPMENT

49 METAL-CLEANING EQUIPMENT —*Solventol Chemical Products, 15841 Second Blvd, Detroit 2, Mich.* 4-page illustrated bulletin gives data on various types including spray washers, rotary drum washers, agitating, pickling, and drying units. Construction features specified.

50 WIREBOUND PALLET BOXES—*General Box Co, 1825 Miner St, Des Plaines, Ill.* 8-page catalog pictures and describes variety of applications for Generalift standard size boxes.

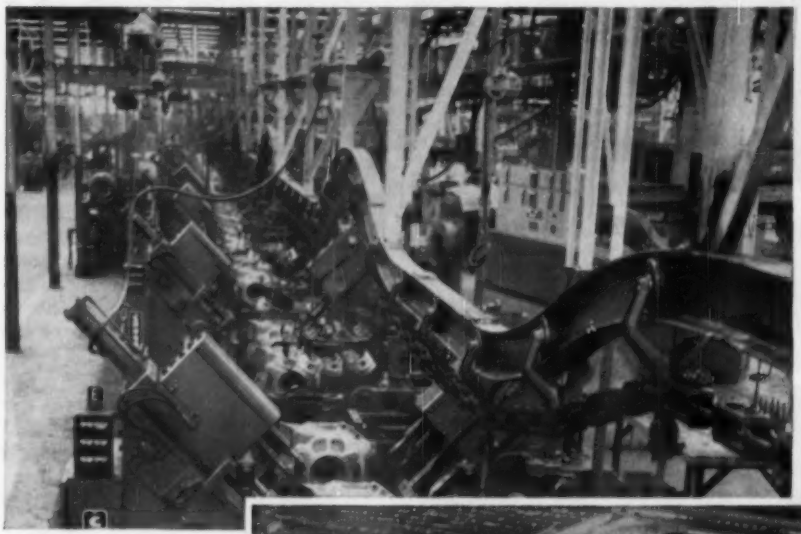
51 INDUSTRIAL GLOVES & FINGER COTS—*Wilson Rubber Co, Industrial Div, 1200 Garfield Ave S W, Canton 9, Ohio.* 16-page illustrated catalog covers complete line of Wil-Gard products. Application table shows resistance ratings of various glove materials to 199 chemicals and solvents commonly used in industry.

52 PROTECTIVE COATINGS—*Markal Co, 3052 W Carroll Ave, Chicago 12, Ill.* 4-page illustrated catalog contains information on line designed to protect metals from scaling and corrosion at temperatures as high as 2100 F; for carburization and decarburization control during heat treating; protection against acids, alkali, salt spray. Four basic types described with application data.

PARTS AND MATERIALS

53 MOTOR CONTROLS—*Allen-Bradley Co, 136 W Greenfield Ave, Milwaukee*

In the Spectacular PLYMOUTH ENGINE PLANT you see



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(Above) View of Plymouth Engine assembly line

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Fitchburg Engineering Corp.
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Industrial Metal Products
The LaPointe Machine Tool Co.
Landis Tool Company
The R. K. LeBlond Machine Tool Co.
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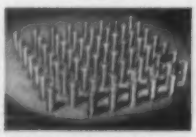
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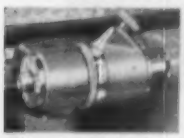
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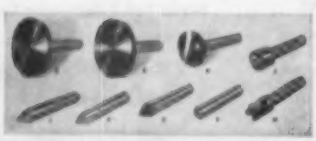
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4, Wis. 132-page illustrated catalog gives operational, dimensional, and price data on manual and automatic controls. Enclosures available for operation in damp, hazardous dust and gas locations discussed and pictured.

54 STAINLESS STEEL FASTENERS —*Allmetal Screw Products Co, 821 Stewart Ave, Garden City, Long Island, NY.* 8-page illustrated condensed stock list covers 37 basic fastening devices. Includes data on threads, head and point styles, and grades of stainless steels.

55 AIRCRAFT SWITCHES — *Micro Switch, Div of Minneapolis-Honeywell Regulator Co, Freeport, Ill.* 24-page catalog 71 describes 70 different enclosed snap-action switches. Illustrations, dimensional drawings, electrical ratings, technical information included.

MISCELLANEOUS

56 COPPER AND SILVER BRAZED ASSEMBLIES—*Wall Colmonoy Corp, 19345 John R St, Detroit 3, Mich.* 4-page illustrated catalog describes facilities and services provided by the company's Walleo Manufacturing Div for design, development, and manufacture of assemblies.

57 ENGINEERING SERVICES—*Engineering Service, Inc of America, 21460 W Eight Mile Rd, Detroit 19, Mich.* 8-page illustrated folder describes facilities for tool, die, and machine design; production engineering and product design and development services for industrial and metalworking plants.

ROUND TABLE *Discussion*

TICK-TOCK TRIG

Would it help shop figuring if all calculations for angles were in degrees and decimals of degrees, or is the established system with minutes and seconds too firmly entrenched?

THE IDEA that "Everything is going all right, why change?" is no stranger to any of us. Yet if we care to look around we quickly become aware of the fact that change is a natural process that has to be recognized and taken advantage of, because we know that a mind that lives in the past will ultimately become unable to cope with the present and eventually decay.

Rather a grim picture, I'll admit, but we know that all the advances we have made in machine shop technology were not attained by men who were satisfied with the status quo of their particular ear. These men were receptive to new ideas and imbued with the thought of making them work and improving them wherever necessary.

In every shop you will find good mechanics who are not receptive to new ideas or new processes, and in many cases they do not qualify as old-timers. In one shop I know of, some new vertical milling machines were installed that incorporated a micrometer setting arrangement in the head. The foreman of that shop told me he had quite a time convincing some of the men that it was simpler and more accurate to use the micrometer dial and bring the head and the cutter to the work than raise the table and bring the work to the cutter. He tells me he still has a sneaking suspicion that some of the die-hards still cling to the old method when he isn't around and crank up the table to the cutter, disregarding the micrometer dial in favor of the graduations on the elevating screw dial.

Whether we like it or not, Ed, the old order changeth yielding place to new, so climb on the bandwagon. It's a lot easier than having to run in order to keep up with the parade.

Robert S Alexander
Glastonbury, Conn

IN MY opinion, it would help shop figuring if all calculations for angles were in degrees and decimals of degrees because it is easier to work with such data instead of minutes and seconds of arc. Although this standard practice of minutes and seconds has been long in use, I think it's time for a change to "tick-tock trigonometry" with decimals to make it easier for shop application and use. To assure accuracy and greater ease

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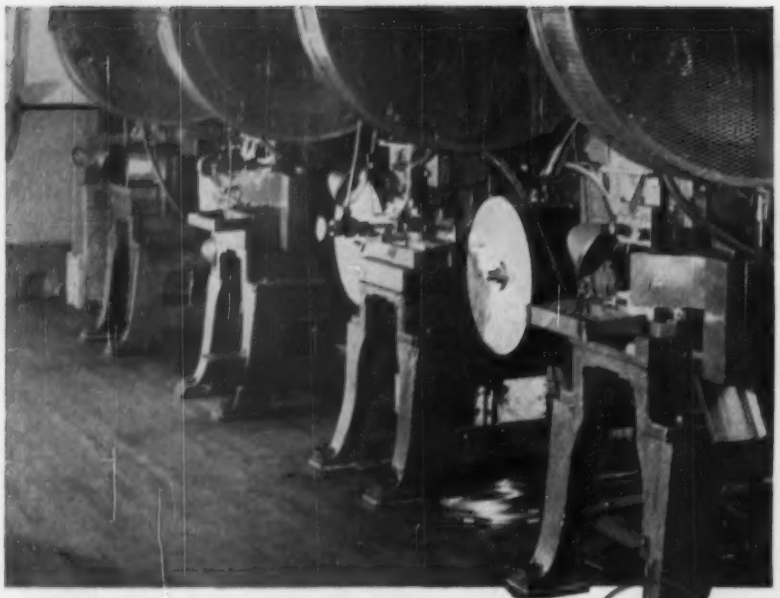

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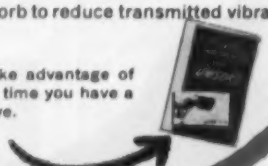

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in manufacturing, especially where close work is involved, it would seem to me that the use of a system that embraces tenths and hundredths of a degree instead of minutes and seconds merits adoption and presents no serious problem for use in the shops.

I believe that the decimal system of angle calculation is superior to the established system of minutes and seconds because it is more easily used and eliminates troublesome converting back and forth. With the decimal system a simpler and less confusing form for shop figuring is possible than with minutes and seconds, and it is thus better fitted for general application in the shop. It is only after the adoption of the decimal system that a time-saving method for shop calculation is possible. Standard data for angle calculation in decimal notation can more easily be handled than the intricacies of minutes and seconds.

Indicating data for angle calculations in degrees and decimals of degrees is practicable and desirable both from an engineering and shop standpoint. However, some mechanics and machinists who are used to working with degrees, minutes, and seconds may object to changing standard data. Oldtime mechanics and other shop men may claim that unnecessary changes bring unnecessary difficulties. They understand minutes and seconds of arc and will not take kindly to a new decimal system that upsets an established method which ostensibly has served well in the past.

Suggestions by shop men pertaining to any phase of production, product design, engineering plans and

"Y' know m' dear . . . I could certainly use somebody like that . . during our rush season . . ."

data should be encouraged. I believe idea, before he actually uses the data.

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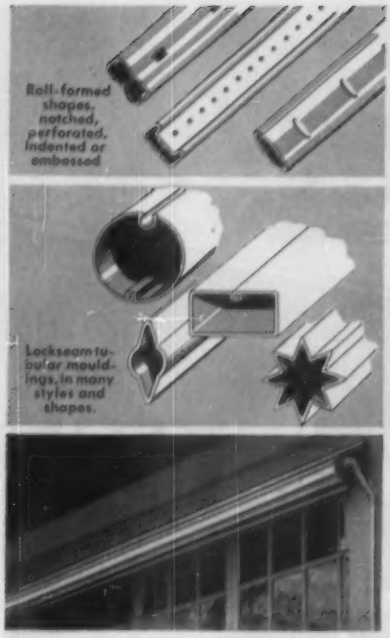

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data should be encouraged. I believe that the progressive shop man will hardly fail to accept the innovation of decimal calculations for angles instead of using minutes and seconds. He will see the advantage of a device which will facilitate shop figuring and make his work easier. It will eliminate the unnecessary time spent in confusing conversion of figures to minutes and seconds.

The changing of standard data by the Engineering Department to facilitate calculations for angles is a function of that department; it should not be unduly influenced by the conflicting opinions of different workers in different shops. However, where the Engineering Department considers it essential to adopt a new method of angle calculation, it might be a good policy to inform the shop foremen in advance of the use of the new method so that it will not come as a complete surprise and they will be able to give timely instructions to their men.

It's going to take some re-educating to pry some mechanics loose from the old system of angle calculation. But eventually most shop men, including old-timers, will admit that angles are easier to calculate with the decimal system.

It has been my experience that most modern engineering departments will lean over backward to follow the best practice in drafting plans and preparing standard data for use in the shop to insure that the product designed will be manufactured with the greatest accuracy and lowest cost. Where the Engineering Department takes such pains to make things easier for the shop man it would be small potatoes for him to label the new engineering trig tables and data sheets as a crack-pot idea, before he actually uses the data. It may be hard to win some old grumps over to the new idea because they have to modify their entrenched ways of thinking away from the traditional and out-moded minutes and seconds system. It's clearly up to the foreman to get his doubting-Thomas workers to break through the barriers of their set ways of unprogressive thinking.

Harry Kaufman
Philadelphia, Penna

"Finally got it, eh?"

THE USE of a decimal system certainly has its advantages whether we like to admit it or not. Naturally those of us who have spent many years in the use of degrees, minutes, and seconds as well as fractions of inches do not like to see the change. The first and biggest reason is that over the years we have developed the know-how of using our complex system which only a relative few can understand and use with any degree of skill. So we despise anything that might take off the cloak of expertness and leave us just as anyone else. We yell because we are losing our status and can no longer brag about being able to easily convert fractions and degree minutes into usable form for production of tools and dies.

How this wide-awake country of ours for the past two hundred years could ever stay so stagnant in regard to decimals is a mystery. We are and have been out of step with all other countries in this respect. Perhaps, again, we want to be different and be able to say we do this the hard way. We all must admit that a drawing which is converted to decimal is much easier to use providing we are equipped to handle decimal work in the shop. It calls for decimal rules and measuring equipment in general. It is much more accurate, for when converting fractions or degree minutes to something that can be added or laid out we often fail to get that last fraction of the dimension accounted for. In the decimal system there is no conversion and we simply add up the figures and lay it out to the accuracy we desire.

The engineers are smart. They are making things easy not only for themselves but for the shop as well. Yet we are too ready to condemn everything new—condemn anything that engineers who are graduates of universities and colleges present. They are "crackpots" and are always trying to upset the applecart. Actually most engineers are hoping that

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they can help the shop by changing our antique methods and thereby lower costs. The lowering of costs means the survival of many companies and the jobs of thousands.

It is better that we stop to think a little about the general welfare of the company as a whole before we condemn new methods that have the ability to lower operational costs. Sure you will be upset for a time. It will be hard for you to get used to the decimal system if you want to make it difficult. Actually this change is the easiest that has ever been presented. We use decimals on the side but don't like to admit it. We want to appear exclusive.

While we are on the subject, perhaps we should comment right here that our present engineering shortage has partly stemmed from the attitude of our industrial companies and employees within the organizations taking the attitude that they do. The general feeling throughout the organization is that an engineer is a screwball—he is overpaid and doesn't know the score. In other words he is an educated fool.

This thinking has been so inbred in our companies throughout the country that engineers have many, many times left their jobs and gone into something else. The low pay (lower than the shop worker) is not attractive when abuse is also placed upon the young engineering graduate. When this country is really willing to learn about engineers and the work they can do, and recognize them as a genuine professional group, then perhaps we will no longer have problems of getting our younger men and women to enter the engineering schools. But so long as industry is willing to buy and sell engineers at a price so low that the shop personnel who work on the product have a greater take-home pay each month, we will not induce people to become engineers.

Further, is there an engineering shortage? Our colleges graduate engineers each year, but many of them do not stay in the ranks because of the poor pay. Perhaps our industries might try paying something for the technical know-how and ability and thereby stop this decline. Also, better paying positions would draw back into active engineering those who are now getting better and greater salaries elsewhere. Shop people must stop this constant berating of engineers and accept the new ideas, thereby making for their own progress and more jobs for more people.

Charles D Townsend
West Hartford, Conn

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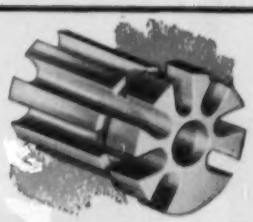

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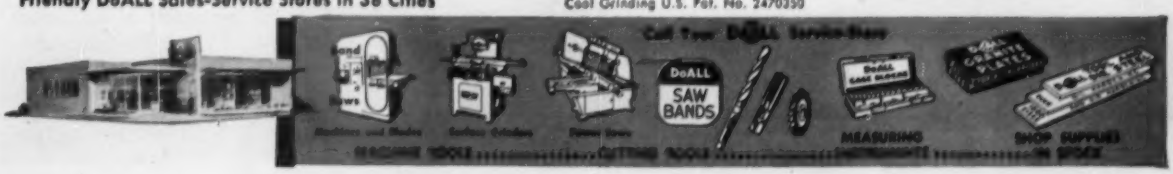

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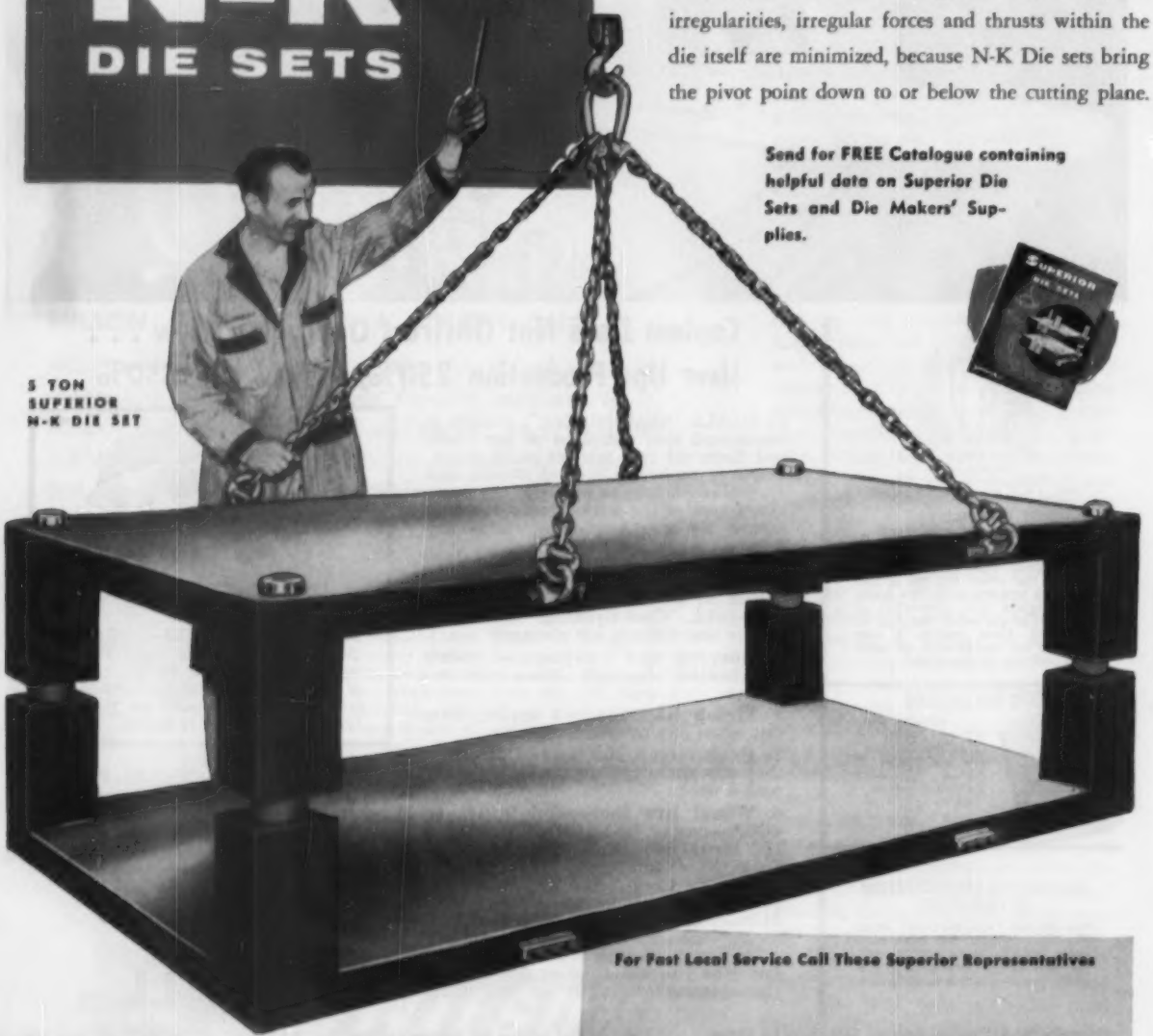

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Names in the News . . .

R M Ewbank has been appointed assistant plant manager at Rohr Aircraft Corp's Riverside, Calif, plant. He was previously production manager of the Chula Vista facility.

L Eugene Root has been appointed vice president of Lockheed Aircraft Corp, and general manager of its new Missile Systems Division. He was formerly division chief of the Rand Corp, and chairman of the Aerodynamics Advisory Panel of AEC at Los Alamos.

Albert S Hovannesian has been named president of Diamond Antenna & Microwave Corp, Wakefield, Mass, formerly the Diamond Microwave Corp. Mr Hovannesian was vice president and manager of the original company. **Daniel K Korian,** formerly engineering director of Tung-Sol Electric Co, is vice president of DA&M.

Edward M Boykin has been appointed vice president, field operations, of Hughes Aircraft Co. **C Harper Brubaker** has been named vice president, planning and programming; **Clarence A Shoop,** vice president, flight operations; and **Roy E Wendahl,** vice president and manager of Tucson, Ariz, operations.

Paul M Platzman has been elected vice president, sales and manufacturing, of Acoustica Associates, Inc, Long Island, NY, manufacturer of ultrasonic equipment. He was formerly manager of the public relations department of John Mather Lupton Co, industrial consultants. **Harold P Baker** has been appointed Acoustica vice president, and **Ralph Reynolds** technical sales manager.

Charles A Shenberger has been named general sales manager of Erie Forge & Steel Corp, Erie, Penna. He was formerly Indianapolis Plant sales manager of Heppenstall Co, Pittsburgh.

OBITUARIES

Walter S Cox, 75, retired vice president of the Camden Forge Co, Camden, NJ, died Nov 9.

Newman M Marsilius, Sr, 66, board chairman of Producto Machine Co, Bridgeport, Conn, and a pioneer in many of the early developments in the milling machine field, died in Bridgeport Oct 17.

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When it comes to checking external threads, a P&W Tri-Roll Thread Comparator can save valuable time and increase your profit margin by reducing inspection costs. But fast, easy operation is only part of the story. *Only* Tri-Roll gives you a complete, visual analysis of lead, angle and pitch in one operation . . . *plus* a direct reading of out-of-roundness by rotating the work. *Only* Tri-Roll offers an alternate, critical check of pitch diameter by using two-rib rolls. And ONLY PRATT & WHITNEY can offer you Tri-Roll Thread Comparators with all their advantages of dependability and economy.

SEND NOW FOR COMPLETE INFORMATION – WRITE FOR YOUR FREE COPY OF CIRCULAR NO. 570
(It's fully illustrated, of course.)

PRATT & WHITNEY COMPANY
INCORPORATED
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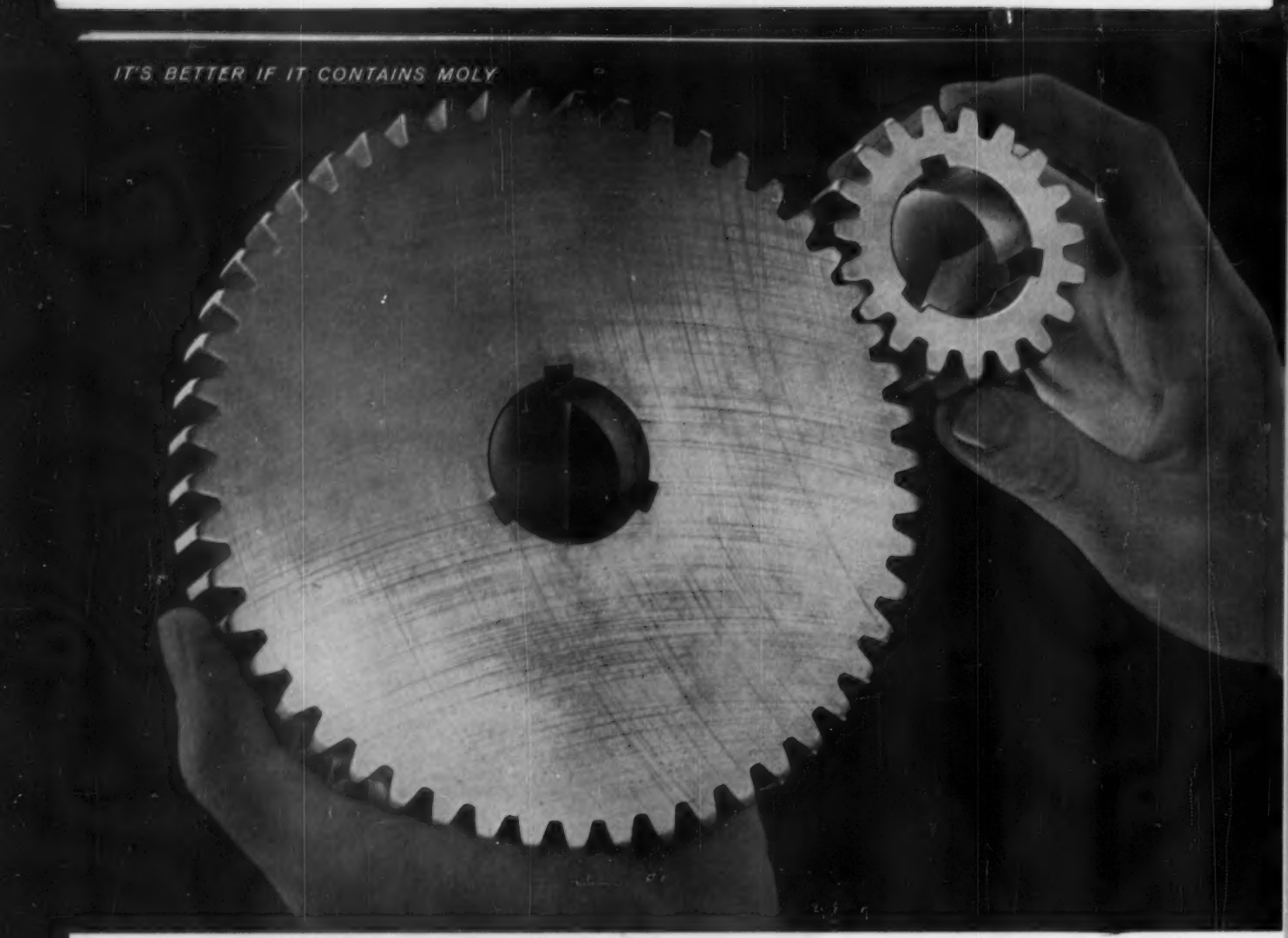
MACHINE TOOLS • GAGES • CUTTING TOOLS



Up to 1% Moly in carburizing steels gives required hardenability economically

Why limit the use of molybdenum to the .15/.25% Mo and .20/.30% Mo contents of the traditional grades? For the contributions of moly do not stop there. Laboratory tests and production runs prove that as molybdenum contents increase up to 1%, hardness increases progressively. A wide range of case and core hardenabilities, therefore, can be obtained – economically, too.

Tests with a series of molybdenum-manganese steels show that these compositions give higher case hardness on a direct quench than other steels of comparable core hardenability. One extensively tested composition, for example, is 0.5% Mo – 0.5% Mn steel. It shows longer life, and is lower in cost than steels previously used. And it produces a higher case hardness with similar or less distortion. What's more, tool life and surface finish are equal or better. Good reasons why several companies have already adopted this grade for automotive gears and other critical applications.

If you use carburizing steels, see what a higher molybdenum content can do for you. Part of the story is contained in the technical article "New Carburizing Steels For Critical Gearing." For your copy, or other technical data, write Climax Molybdenum Co., Dept. 12, 500 Fifth Avenue, New York 36, N. Y.

CLIMAX MOLYBDENUM

THE FRINGECOUNT* MICROMETER

DIRECT MEASUREMENT TO 0.000001"

SIMPLE TO OPERATE...DIGITAL READING

The new FRINGECOUNT micrometer brings laboratory precision with increased speed to your inspection and quality control departments.

This new precision instrument is particularly suited to the measurement of gage blocks, plug gages, other external standards as well as close tolerance production parts.

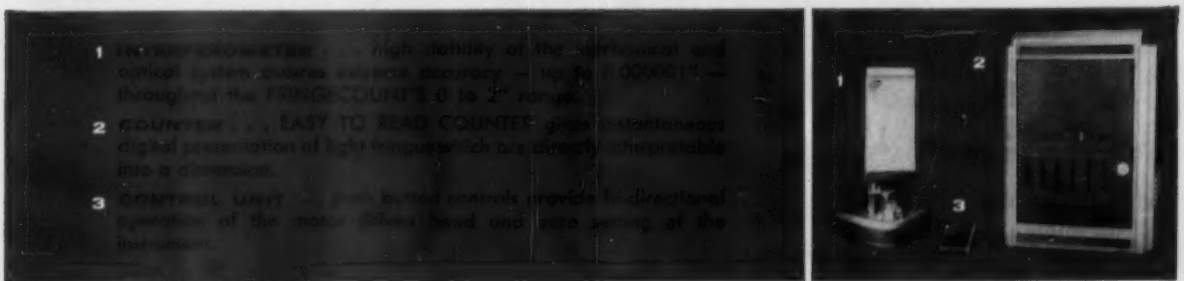
The most stable measuring standard known — the wavelength of light — is the gage put to use in the FRINGECOUNT micrometer. It combines the interferometric principle with an electronic system which counts light fringes — projects them into a digital counter for fast interpretation into a dimension.

Operation is simple — just *two* push-button controls. Other FRINGECOUNT advantages:

- Eliminates need for expensive master blocks.
- Measures flat or round parts equally well, equally fast.
- Adapts to many special measuring situations through the use of different anvils and spindles.
- Requires no calibration. As stable as the light source.

Find out how the FRINGECOUNT can be used in your operation; Write us today, Department AM for Bulletin LP-3521.

*Trade Mark of Link Aviation.



LINK AVIATION, INC.

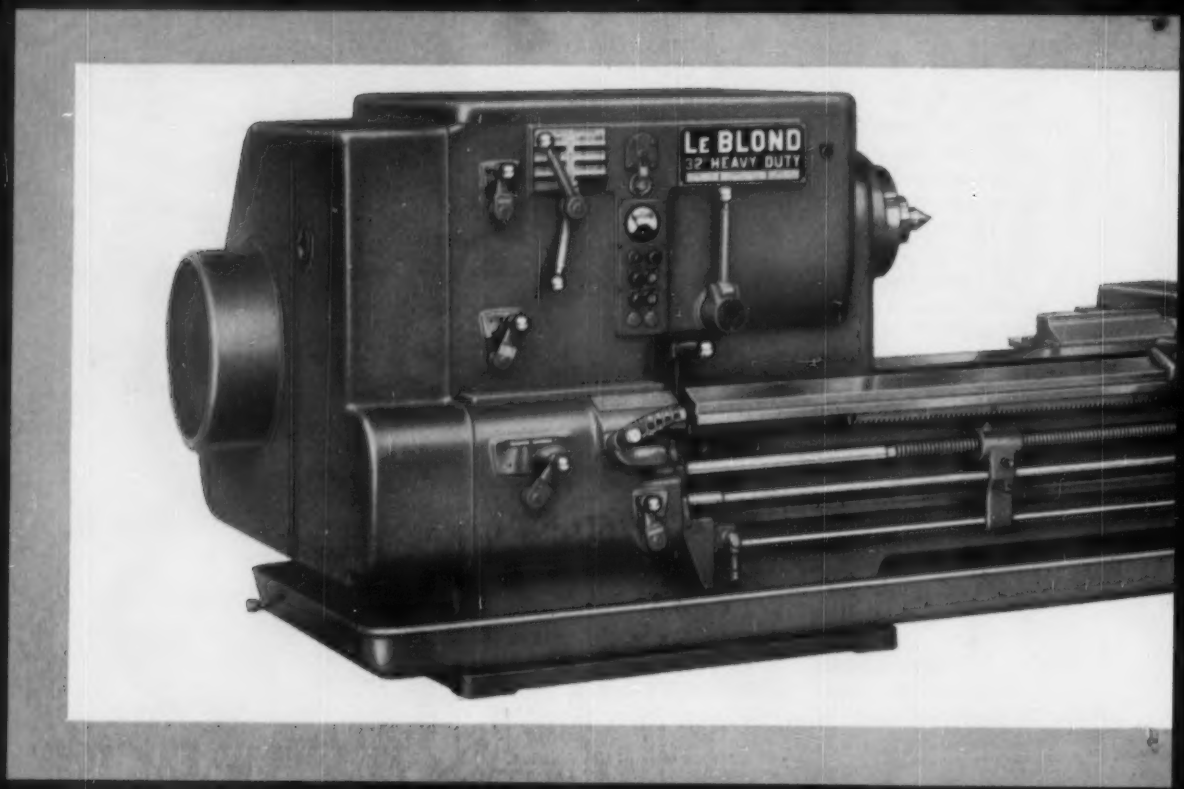
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

BINGHAMTON, NEW YORK

GPE

CLIMAX MOLYBDENUM
to better carburizing steels
• Easy to heat treat
• Low distortion
• Good machinability
• Good wear resistance

LeBlond 25" Heavy Duty Lathes
LeBlond 32" Heavy Duty Lathes (shown)



for today's toughest

power

rigidity

convenience

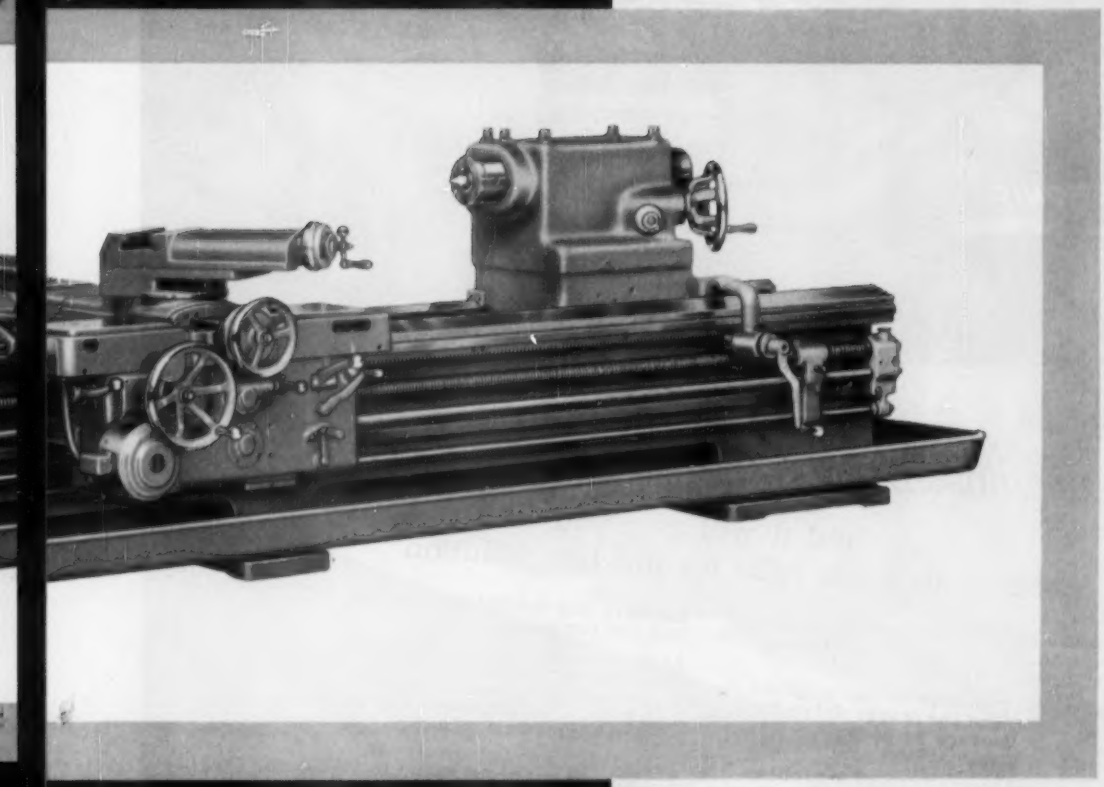
safety

50 hp on the 25″, 60 hp on the 32″. Here's proof of efficiency—maximum no-load friction hp on the 32″ is only 3.4 hp @ 500 rpm.

High-capacity 4-bearing spindle. One-piece double-wall apron. Heavy, short shafts; hardened and ground gears. Hardened and ground compensating steel bed ways.

4-directional power rapid traverse, controlled with a single lever. Direct-reading, color-keyed speed change levers. Single-lever feed control.

Adjustable torque to bring heavy work pieces up to speed safely. Similar adjustments for stopping and jogging.



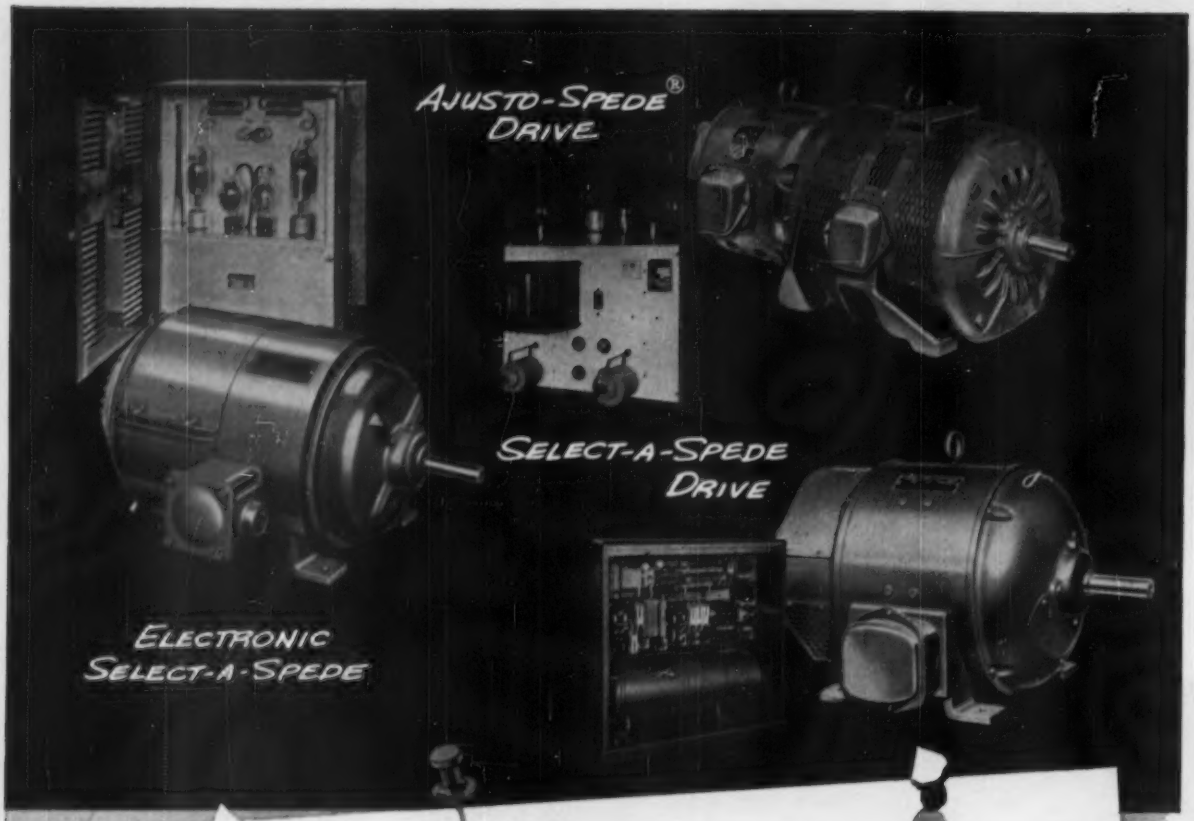
turning

... cut with confidence

LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, O.

World's Largest Builder of A Complete Line of Lathes for More than 70 Years



Is your adjustable-speed drive problem different?

. . . then it will pay you to look to Louis Allis for the best solution

There are several reasons why it pays to come to us with your adjustable-speed drive problems.

First of all, we have no axe to grind. We can recommend the proper drive for your needs because we make them all. There's no compromising.

Secondly, when you turn your problem over to us, we tackle the whole job . . . assume the entire responsibility.

And finally, we have more than just drives to offer . . . we have engineering and manufacturing experience. We've already solved a lot of drive problems. That's why we can tell you what you need, no matter what kind of machine you have.

And here are the drives that can do the job for you:

Ajusto-Spede® Drives. 1 to 75 hp. Constant torque with up to 10:1 continuous speed ranges available. Infinitely adjustable eddy current clutch drive.

Select-A-Spede Drives. 1/2 to 400 hp. 8:1 constant torque speed range with magnetic amplifier control. Adjustable speed DC drive motor built in any enclosure.

Electronic and Static Select-A-Spede. 3/4 to 15 HP DC adjustable speed drive motor with speed ranges up to 100:1 and regulation to 1/2%.

See your Louis Allis field engineer or write and tell us about your problems. There's no obligation.

Write for latest informative literature describing the above drives, or contact your nearby Louis Allis Sales Office.

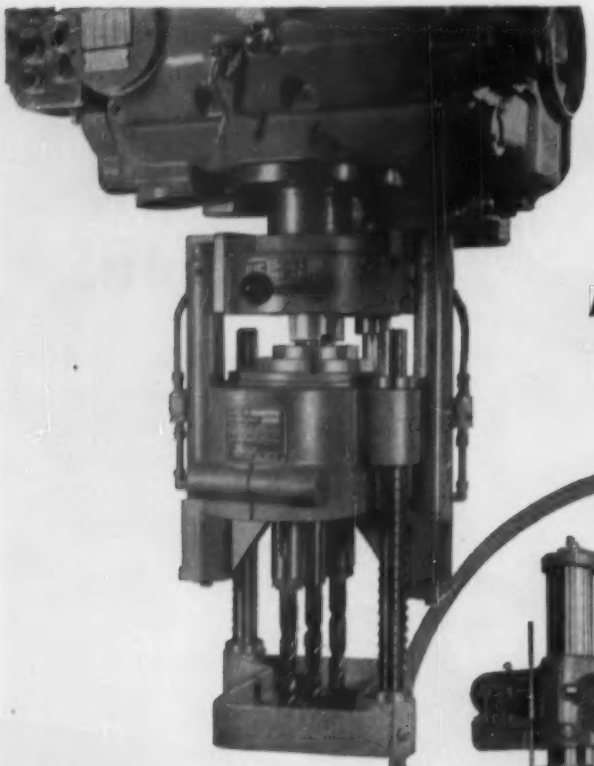
A59-102

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, O.

World's Largest Builder of A Complete Line of Lathes for More than 70 Years

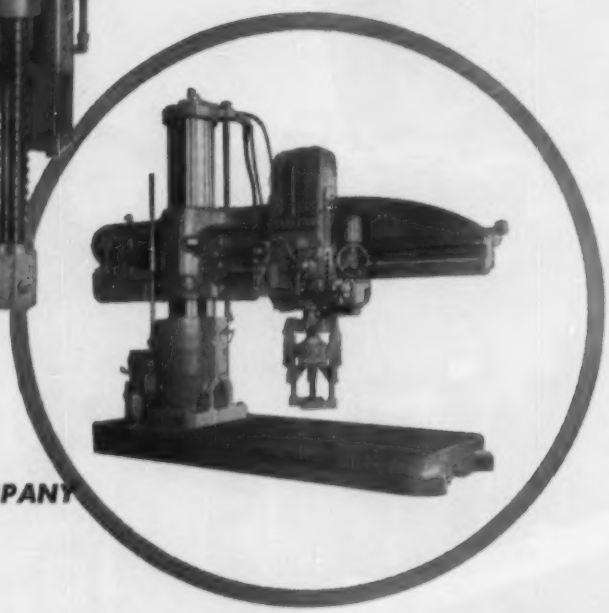
Burr
TRANSFER-MACHINES
Transfer line with 11 stations and 13 spindles for boring and fine boring of cylinder bores and fine milling cylinder head mounting face on cylinder blocks.
Cycle time: 4 minutes
HEINEKEN
LUDWIGSBURGER MASCHINENBAU GMBH
LUDWIGSBURG/WURTT
GERMANY



New

DRILL HEAD AIR COUNTERBALANCE SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES



THIS IS ANOTHER FIRST FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head on the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD — FIVE TO ONE

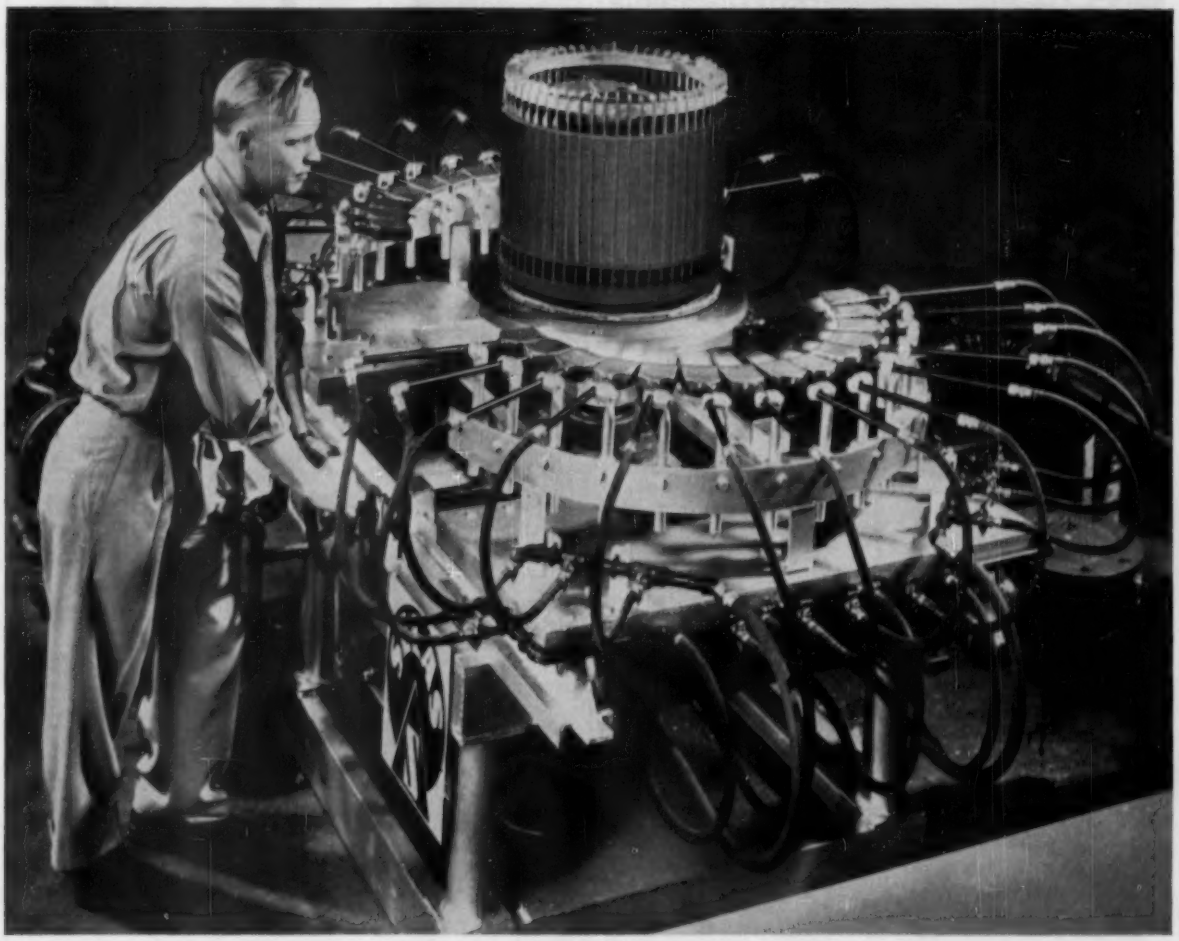
Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

Selas-Brazing Saves 1¾ Hours in Motor Production



Superheat® burners retracting after completion of brazing 20-in. dia, 1100-lb motor rotor, in a Selas custom-built machine. Total floor-to-floor time to braze shorting bars to both end-rings is 35 min; previous brazing method took 2½ hr. Equipment design enables quick change-over of burner arrangement, to accommodate rotors ranging from 8 to 22 in. dia, 100 to 1300 lb. Note how burner selection and placement localizes heat precisely where it is wanted, keeping remainder of workpiece cool.

This Selas method of brazing rotors is currently employed by several large motor manufacturers . . . to accommodate a wide variety of diameters . . . with speedy change-over resulting from the easily adjusted gas-air burners. High heat transfer is achieved with low-cost city gas . . . no bottled oxygen is required. Brazing time is cut as much as an hour and three-quarters on large rotors, and proportionately on smaller sizes.

Individual burner controls provide proper temperatures and specific heat patterns. Any acceptable filler metal (the machine illustrated uses both copper and silver alloy) may be hand-fed or preplaced. Reproducible uniformity, not possible with hand methods, is achieved. Versatility of the compact, space-saving machine meets modern production requirements with simple labor skills.

Selas brazing machines are custom-built to meet specific workpiece requirements. Selas engineers welcome the challenge to design and build equipment to serve your brazing needs.

For additional information on how Selas brazing is utilized in a wide range of metal-joining applications, send for new bulletin No. 312—"Production Brazing and Soldering" and reprint "Mechanized Heating Puts Brazing on the Production Line."

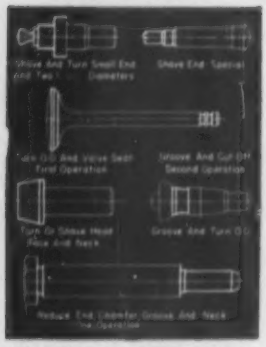
SELAS CORPORATION OF AMERICA DRESHER, PENNSYLVANIA

Heat and Fluid Processing Engineers

DEVELOPMENT • DESIGN • CONSTRUCTION

ECONOMY Automatic Shaving Machines
FOR LOW COST, FULLY AUTOMATIC—HIGH PRODUCTION

Typical parts machined on the "LS"-3600



Illustrating operations completed on the S-4300

ECONOMY Automatic Shaving Machines are designed to perform facing, turning, grooving, necking, cut-off and burnishing operations on bolts, automotive valves, projectiles and similar parts.

They are available in two sizes—the "LS"-3600 for body diameters up to 1/2" and lengths under heads from 1/2" through 4-1/2"—the S-4300 for body diameters up to 1" and lengths 3/4" to 6" under heads. Production rates for the standard "LS"-3600 range from 800 to 2400 finished parts per hour and the S-4300 from 450 to 1800 per hour.

Machines are fully automatic and parts flow from hopper to work pan. Simple adjustments plus easy, rapid set-ups enable operator to operate several machines.

For the ultimate in accuracy, high production and low costs investigate ECONOMY Automatic Shaving Machines.

THE ECONOMY LINE

Automatic Shaving Machines
Automatic Pointing Machines
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THE ECONOMY ENGINEERING CO.
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Designers and Manufacturers of Secondary Operation Machines since 1915

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Reg. U. S. Pat. Off.
INDUSTRIAL GAS EQUIPMENT
NO BLOWER OR OTHER POWER NEEDED
JUST CONNECT TO GAS SUPPLY
BUZZER Equipment, a buy-word since 1911, provides the hottest and quickest heating . . . without blower or power. Wide range of turn down and heat control. You can depend on a BUZZER.

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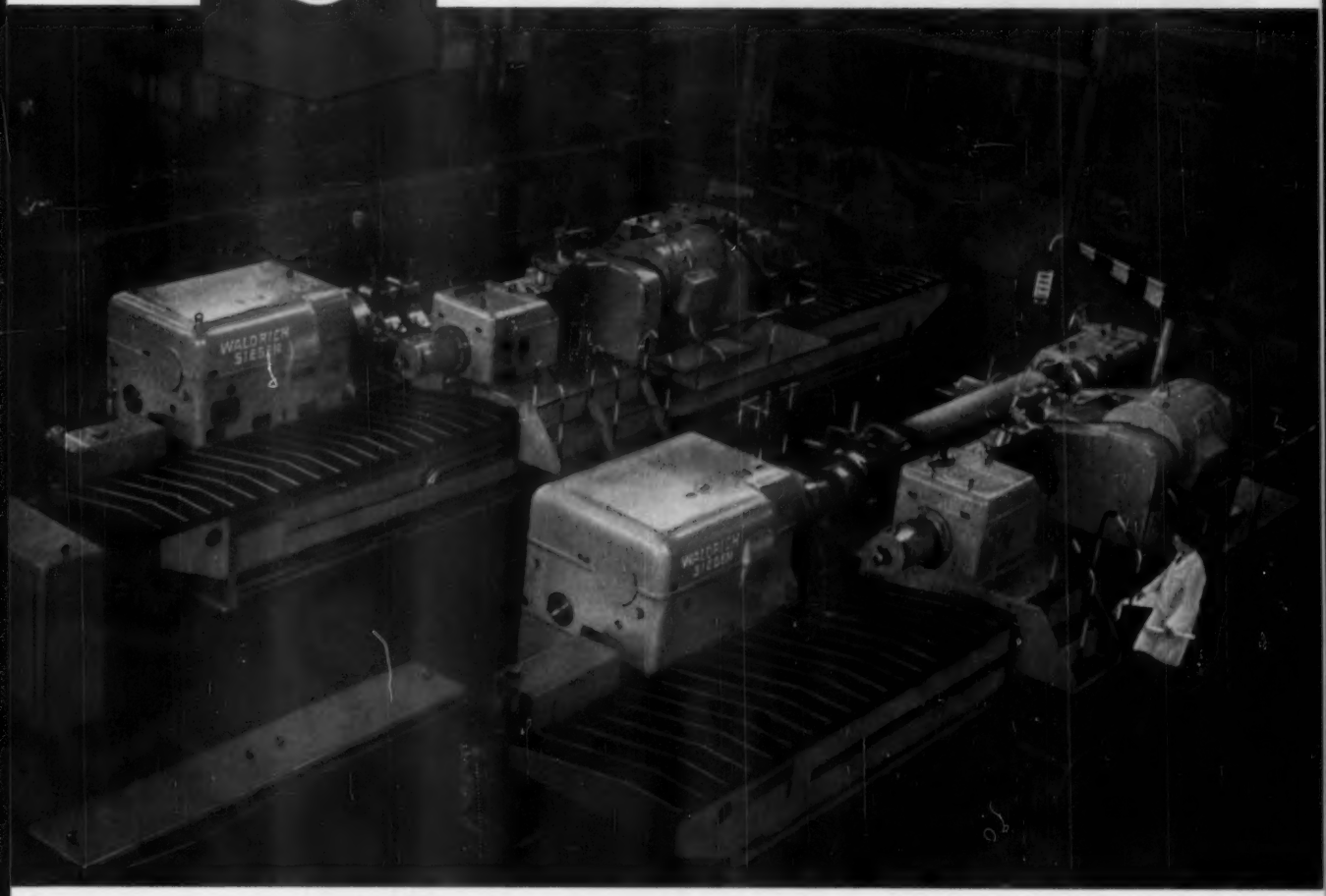
WALDRICH SIEGEN

HEAVY MACHINE-TOOLS



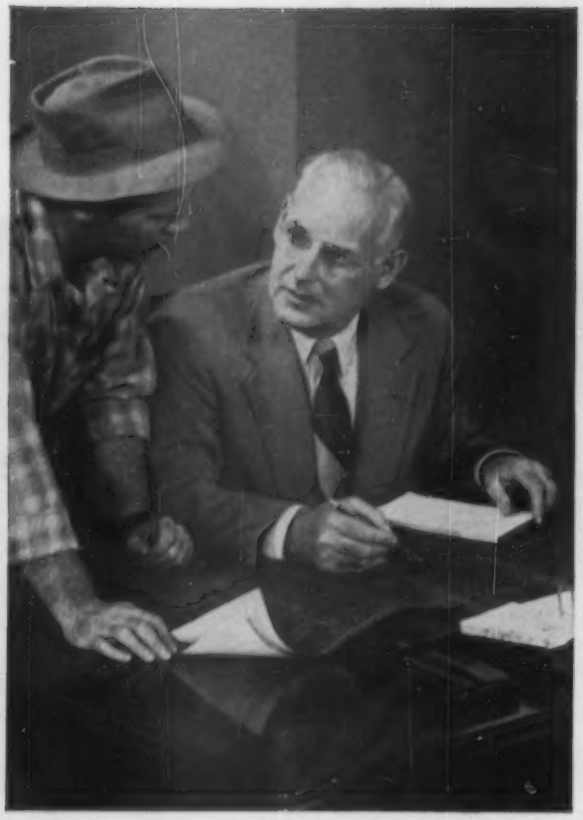
Two WALDRICH SIEGEN ROUGH GRINDERS on Test at our Works.

Grinding with Three Wheels

for roughing of chilled iron rolls. Headstock and tailstock are provided with face-plate to facilitate alignment to the roll barrel. The roll can be supported in steadies. True running of barrel ensures machining the roll with a minimum of material removed. It will pay for you to examine the full savings that can be achieved by the use of this newly developed machine.

H.A. WALDRICH GMBH SIEGEN W.

Please consult our Information Service.
REPRESENTATIVE WANTED



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Get those tough special design jobs off to Columbus Die-Tool for quick action. An outstanding engineering staff backed by 50 years of Company experience can make tough jobs look easy.

Whether it's special tools, jigs, fixtures or even special machinery, you'll find that CDT can build them better, faster and more economically. That's why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool.

Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

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Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

MERRY CHRISTMAS ★ HAPPY NEW YEAR

MAY YOUR HOLIDAY JOYS BE MULTIPLIED!

★ With our customers and friends we want to lay aside business cares for the moment and join in spirit to celebrate the joyous Holiday Season.

For you and yours may it be the best ever, full to the brim with deserved happiness and good cheer, and topped with the rich blessings of peace and good will.

To this is added our best wishes for a most Happy and prosperous New Year.

THE WELDON TOOL COMPANY
3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

Please consult our Information Service.
REPRESENTATIVE WANTED

Makes it possible to x-ray thicker sections –

cuts gamma ray exposure time

Read what the new Kodak Industrial X-ray Film, Type AA, does for you:

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under shop conditions of use.

Whatever your present radiographic facilities, they'll do more work for you with Kodak's new Industrial X-ray Film, Type AA.

This film has greatly increased speed—especially pronounced with gamma rays and high kv. This means you can use shorter exposures with your gamma equipment. It also means you can radiograph thicker sections with your present x-ray equipment.

And with all this increased speed, the new film retains the fine sensitivity characteristics which made Kodak Type A the most widely used x-ray film in industry.

Kodak Industrial X-ray Film, Type AA, can save you time, can extend the possibilities of your present radiographic equipment. Find out all the details. Get in touch with your x-ray dealer or Kodak Technical Representative.

EASTMAN KODAK COMPANY
X-ray Division Rochester 4, N. Y.

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TRADE MARK

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

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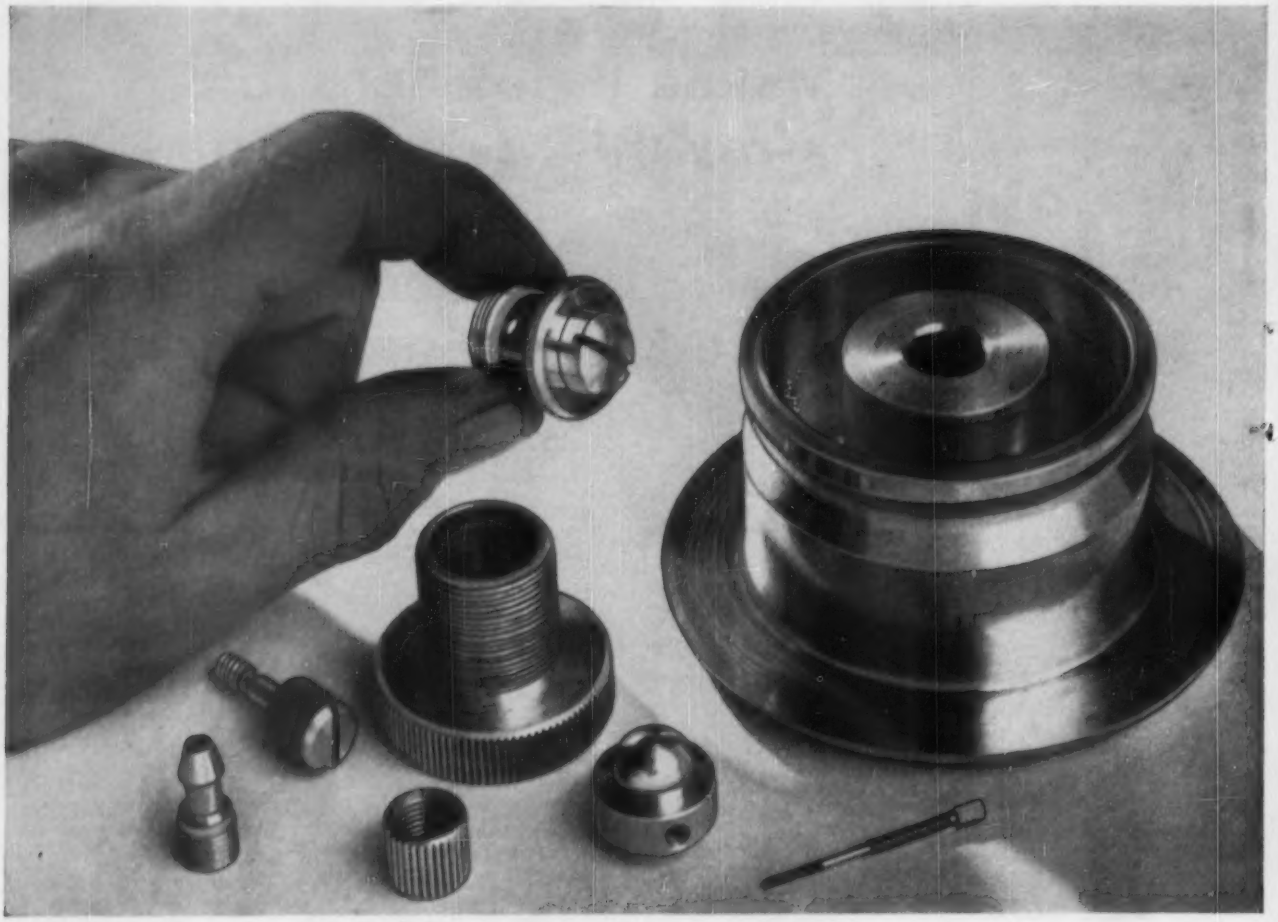


Typical parts machined by Taylor Instrument Companies from Alcoa Aluminum Screw Machine Stock

HOW TAYLOR INSTRUMENTS* GET A LIFT AND A LONG LIFE FROM ALCOA SCREW MACHINE STOCK

Where measurements must be precise, you'll find Taylor Instruments . . . insuring a jet pilot's safe descent by parachute . . . warning a ship's captain of changing weather . . . telling the doctor your temperature and blood pressure. In everyday life, and in thousands of industrial plants, Taylor Instruments have helped America measure its progress since 1851.

What are Taylor's requirements for screw machine parts? Precision, naturally. Corrosion resistance is also important since many Taylor Instruments are installed where maintenance is virtually impossible. Because many Taylor products, like your home thermometer, are mass-produced, cost is exceptionally important in the selection of a screw machine stock.

With these requirements in mind, read why Taylor Instrument Companies use Alcoa® Aluminum Screw Machine Stock. See if their experience plus the inescapable economics of aluminum versus brass doesn't dictate a hard look at all your screw machine parts. For competent technical help in making such an analysis, simply call your local Alcoa sales office listed under "Aluminum" in your classified phone book. Aluminum Company of America, 868-M Alcoa Building, Pittsburgh 19, Pennsylvania.

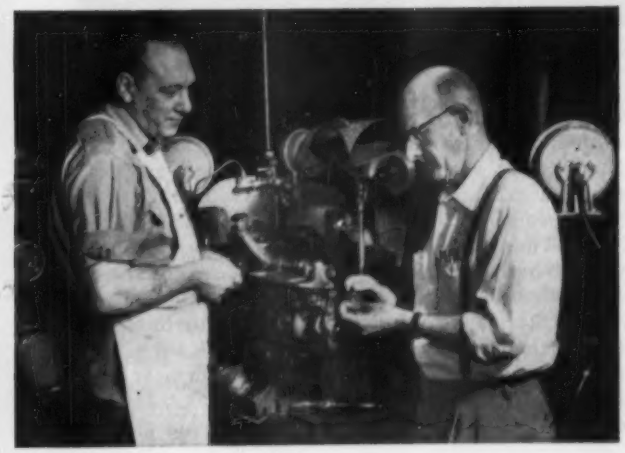
*Taylor INSTRUMENT COMPANIES

IN PURCHASING

Asst. Purchasing Agent, J. R. Mahan, says, "Dependability is the single most important requirement of a supplier. This we get in full measure from Alcoa. Quality has always been dependable. Deliveries have come when promised. Service and technical help are always available to us and their answers are right. We find this Alcoa dependability also applies to Alcoa distributors from whom we get prompt delivery."

IN METHODS ENGINEERING

H. D. Klitgord, Manager, Methods Engineering Department, says, "We have a continuous cost study of materials for all of our screw machine parts. Equal or better performance has been our criterion in every instance where money could be saved. We are saving $100,000 per year by using aluminum. Our conversion at present is about 40% and we anticipate an increasingly greater use of aluminum bar stock."



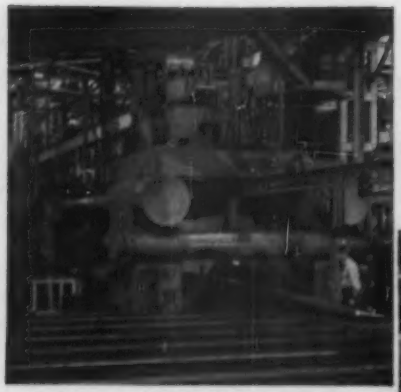
IN PRODUCTION

Mr. H. Bubel, Group Leader, Automatic Screw Machine Department, says, "We are machining aluminum at the maximum production rates possible. Alcoa technical people have been of great assistance to us in recommending cutting oils and tools, and helping us maintain our close tolerances and fine finishes."

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
SCREW MACHINE STOCK



Giant press extruding an aluminum spar section.

For the King and Queen of Extrusion Presses . . . it's FIRTH STERLING HOT WORK DIE STEEL

2500 lb. die blanks and a finished extrusion die of Firth Sterling HWD Hot Work Die Steel.

At Kaiser Aluminum & Chemical Corporation's Halethorpe Extrusion Works, operated under a U. S. Air Force lease, are two 8,000 ton capacity extrusion presses—the largest operating units designed and built in the United States. Presently extruding large, complex aluminum shapes—wing spars, wing panel sections, and missile hull sections, for the aircraft industry, the two giant presses, named Rex and Regina, utilize dies made from Firth Sterling Hot Work Die Steel.

Yes, Firth Sterling HWD is a monarch in its own right, with properties capable of withstanding the tremendous pressures of this king and queen of extrusion presses. This intricate process requires materials that can operate continuously in volume production without replacement. These giant presses each weigh 1500 tons and are capable of extruding aluminum shapes more than 85 feet long and over 1200 pounds each in weight. The use of Firth Sterling HWD is tangible evidence of the high opinion modern die makers have of the quality of the material.

HWD Steel is just one of the Firth Sterling line of more than 50 Tool and Die Steels. Ask for a Firth Sterling engineer to cooperate in your next die making problem to assure the correct grade and analysis.

R-326

Firth Sterling

—INC—

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MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON, HARTFORD

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PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN

HONEYWELL

these switches are EVERY DAY KEYS to automatic operation of your plant machinery

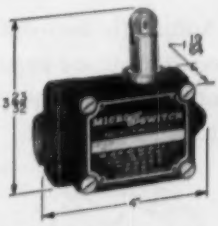
These MICRO SWITCH precision switches are low-cost tools of automation in industrial plants everywhere.

By their use plant superintendents, electricians and maintenance men have tremendously increased the work capacity of existing machinery and the personnel who operate it.

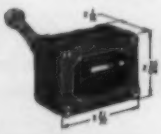
The MICRO SWITCH way is the modern way to improve production capacity on a modest budget. These switches are readily available everywhere. They are stocked by authorized distributors in key cities. Look under "Switches, Electric" in the Yellow Pages. Technical assistance on switch problems is available from MICRO SWITCH Engineering Service at any branch office.

Send for Catalog 101 on "Switches for Industry"

Here is the Type "LS," a small, high capacity two-circuit limit switch. The durable aluminum enclosure protects the switch from physical damage. Seals prevent foreign matter from entering the switching chamber.



High capacity Type "P" enclosed switches are for applications which require a small enclosed switch to handle a large electrical load.



Splash-proof Type "OP" switch assemblies are for locations where splash of liquids would hinder performance of less adequately protected switches.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

MILLS MCKEESPORT, HARTFORD, DETROIT, HOUSTON, HARTFORD
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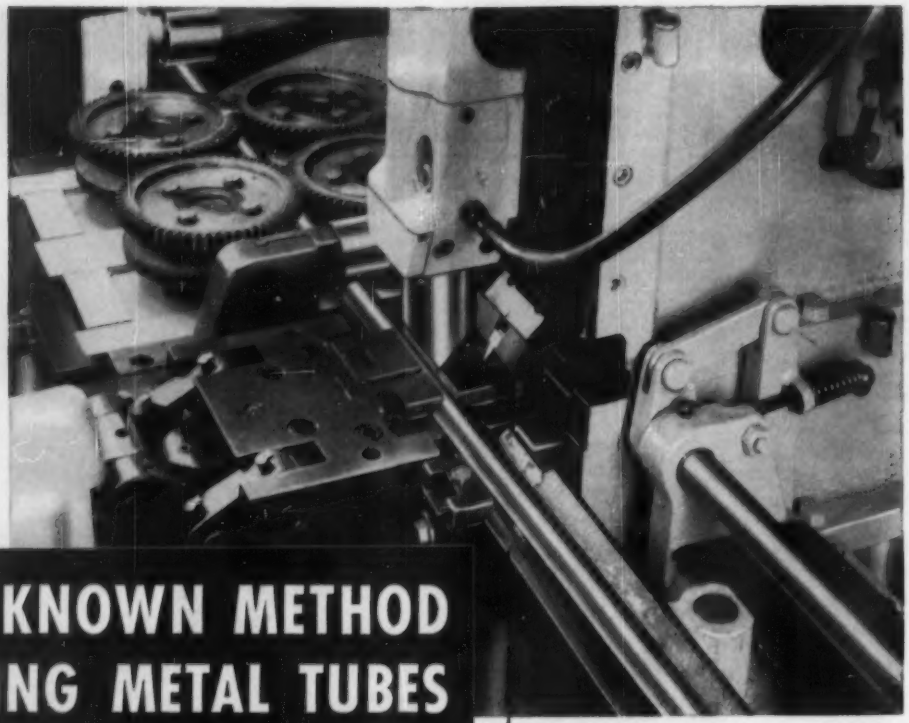
Zirconium



FASTEST KNOWN METHOD OF CUTTING METAL TUBES

Automatic continuous operation of up to 6,500 cut-offs per hour is approximately 3 to 8 times greater than the speed of competitive methods.

Cutting action in Grieder Tube Cut-off Machines is accomplished by two blades actuated by a crankshaft. A horizontal cut is made first, through the wall thickness of the top of the tube. The vertical blade descends into the opening and completes the cut. The tubing is held firmly in dies which operate as a vise preventing any distortion. Lengths can be held to plus or minus .002" on light wall tubing and to approximately .003" on heavier wall tubing.

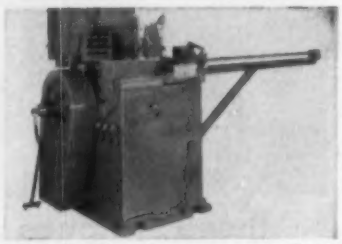
Automatic hoppers for feeding tubes and related automation equipment are available in conjunction with Grieder Tube Cut-off Machines for specific applications. Tell us what you want to accomplish.

Grieder Tube Cut-off Machines are slicing tubes and slashing costs in most major industries. Write for literature.

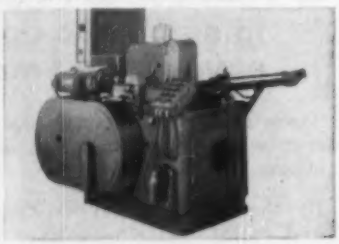
GRIEDER INDUSTRIES, INC.

P. O. BOX 169, BOWLING GREEN, OHIO

THREE STANDARD MODELS



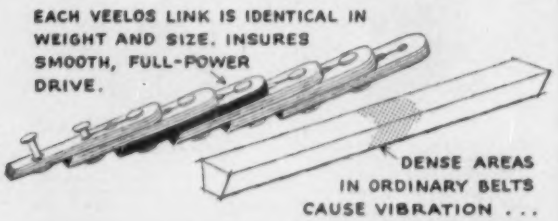
NO. 1000-MAC cuts tubes up to ¾" OD and up to .062" wall thickness.



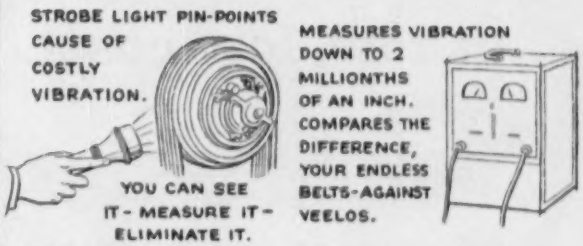
NO. 2000-MAC cuts tubes up to 2" OD and up to .125" thickness wall.

NO. 4000-MAC cuts tubes up to 4" OD and up to .250" wall thickness.

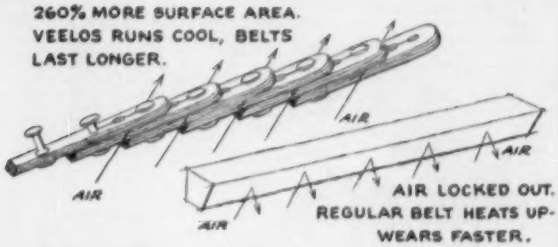
Six Reasons Why Veelos Adjustable V-Belts Are Better For Your Drives!


EACH VEELOS LINK IS IDENTICAL IN WEIGHT AND SIZE. INSURES SMOOTH, FULL-POWER DRIVE.
DENSE AREAS IN ORDINARY BELTS CAUSE VIBRATION . . . MACHINE WEAR

1. Balanced construction of Veelos Belts assures you faster, cleaner work, less rejects . . . less bearing wear. Each link and stud is identical in size and weight. Ordinary belts have varying spots of density which cause excess vibration—chatter marks, machine wear.


STROBE LIGHT PIN-POINTS CAUSE OF COSTLY VIBRATION.
YOU CAN SEE IT - MEASURE IT - ELIMINATE IT.
MEASURES VIBRATION DOWN TO 2 MILLIONTHS OF AN INCH. COMPARES THE DIFFERENCE, YOUR ENDLESS BELTS-AGAINST VEELOS.

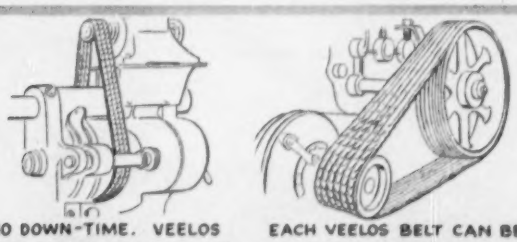
2. Electronic proof—up to 90% less vibration! With a vibration analyzer, you see, on your own machine, how Veelos belts decrease vibration up to 90% over any belt you're now using. This amazing Veelos test pin-points the belt that has the "invisible shakes."



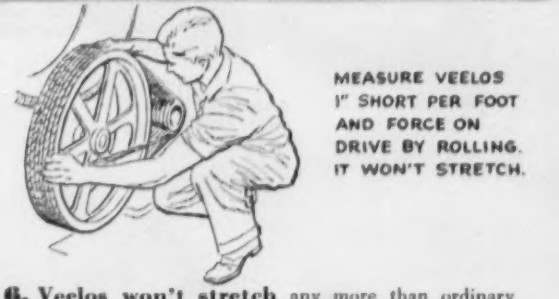
3. Cooler running—long life! Veelos breathes! Constant circulation of air keeps Veelos running smooth. Regular V-belts have no chance to cool, heat builds up from the inside . . . causes slippage, wastes power, heats bearings, reduces belt life.

AREA CONTACT
POINT CONTACT
PERFECT VEELOS FIT. EXTRA THICKNESS AND MACHINE-CUT SIDES PREVENT BOTTOMING. MEAN CONSTANT POWER.
POWERLESS POINT CONTACT OF ORDINARY V-BELT. BULGES, SLIPS, CAUSES UNEVEN SHEAVE WEAR.

4. Greater flexibility reduces slippage! Sectional construction, beveled links allow greater flexibility, longer belt life. Each link moves around sheave independently and maintains full contact, constantly. Full area contact allows shorter centers, smaller sheaves.


NO DOWN-TIME. VEELOS FITS ANY DRIVE - WITHOUT DISMANTLING.
EACH VEELOS BELT CAN BE ADJUSTED - NO NEED FOR EXPENSIVE MATCHED SETS.

5. Simple installation "knocks out" down-time! Saves up to 50% installation time on outboard bearing drives, more when belt length isn't in stock. No resetting, tilting or moving motors. Veelos can be made any length, can be changed by adding or removing links.



6. Veelos won't stretch any more than ordinary endless V-belts when it is properly installed. *Remember—measure Veelos 1" short per foot and roll on drive as tightly as possible.* With the first few revolutions Veelos studs accept a permanent set into the sections they connect.

4 TYPES—FOR ALL DRIVES

REGULAR For general service
OILPROOF For oily and hot drives
COATED For wet or oily drives
STATIC-CONDUCTING For explosive atmosphere

VEELOS
THE BALANCED LINK V-BELT

Known as Veelink outside U.S.A.

For all sizes and types of drives. Double-V available for serpentine drives.

Write for free Veelos Data Book or Veelos Vibration Demonstration to:

MANHEIM

Manufacturing & Belting Co.
401 Stiegel St., Manheim, Pa.

"Industrial Belt Specialists Since 1911"

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How to GET THE JOB DONE at low, low cost!

benchmaster

world standard in small presses

Manufacturers all over the world have found Benchmaster Punch Presses the answer to *high production with minimum investment!* With their *compactness requiring little floor area, fast crankshaft speeds* and *high number of strokes per minute,* any Benchmaster will tremendously outproduce big presses on work where high tonnage is not necessary.

If your job is *beyond* the tonnage capacity of a single Benchmaster, investigate our Multiple Ram Presses ... 2 or more Benchmasters operating in tandem off a single crankshaft. You get *more bed area, progressive die operation* with *individual die stations, lower die cost* and *easier die maintenance* ... at savings up to 50% in press cost!

DON'T OVERLOOK THE POSSIBILITY OF A SPECIAL BENCHMASTER designed to accommodate your specific job. Ask for our recommendations!

BENCHMASTER ACCESSORIES

Built by *press experts* for *production experts!*

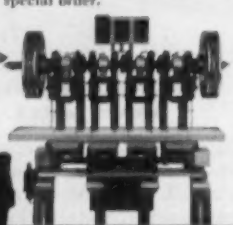
These accessories make press operations more automatic, eliminate unnecessary cost and get more work out per shift! You'll find them a big advantage on all Benchmasters and other presses, large or small!

KOIL KRADLE AND ROLL STRAIGHTENER COMBINATION — Straighteners also available as single units. Feed rate variable 25 to 100 rpm, straightener thickness capacity .200". Other sizes available.

KOIL KRADLES — Supplies a slack loop from which any machine can draw. Takes the drag off automatic feeding devices, increases feeding accuracy on progressive or multiple die operations; puts through more footage per hour. Many sizes: 1200 to 4000 lbs., 36" to 60" coil diameters, 10" to 28" widths. Larger capacities available.

ROTARY INDEX FEEDS — Converts your presses for automatically marking, crimping, assembling, reaming, trimming, etc., at speeds up to 6000 strokes per hour. Easy installation — 4 bolt mounting. Two sizes: 12" or 15" tables, 10 or 12 stations. Larger sizes on special order.

AUTOMATIC FRICTION ROLL FEEDS — Lowest price on the market! Ideal for production work feeding small coil or strip stock. 3", 5", 7" and 9" roller widths. Two models, feeds adjustable from 0 to 3" cutoff or 0 to 6" cutoff. Plain, knurled or rubber covered rollers. Fits Benchmasters and other presses.



When you need a *SMALL MILL* remember Benchmaster. One mill handles both horizontal and vertical milling jobs. Takes an astonishing bite, yet holds close, precision tolerances.

CHECK YOUR BIG PRESS PRODUCTION AGAINST THESE OUTPUTS

... Then choose a Benchmaster for more parts per hour!

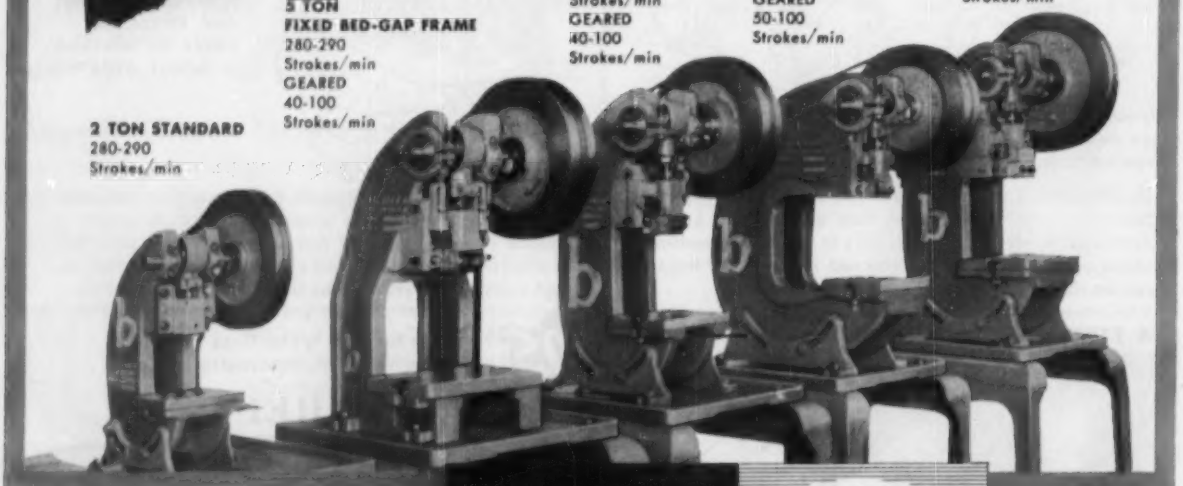
2 TON STANDARD
280-290
Strokes/min

5 TON FIXED BED-GAP FRAME
280-290
Strokes/min
GEARED
40-100
Strokes/min

5 TON STANDARD
280-290
Strokes/min
GEARED
40-100
Strokes/min

5 TON DEEP THROAT
280-290
Strokes/min
GEARED
50-100
Strokes/min

8 TON STANDARD
180-190
Strokes/min
GEARED
40-100
Strokes/min



FREE CATALOG — Shows complete line of Benchmaster *money-saving equipment* for stamping and metal working industries. Write for free copy or ask your Benchmaster dealer!

benchmaster

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A HANDFUL OF CHIPS...

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Such remarkable chips also indicate the *quality at low-cost* of *finished pieces* machined from Chase Free-Cutting Brass Rod. Smoother, cleaner pieces that take precision threads and sharp knurls—require less polishing—and simplify lacquering, enameling or plating.

The Chase warehouse near you stocks standard mill lengths in many different cross-sections. Special shapes that *save even more* machining time can be made to order.

Write, wire or phone today!

Chase

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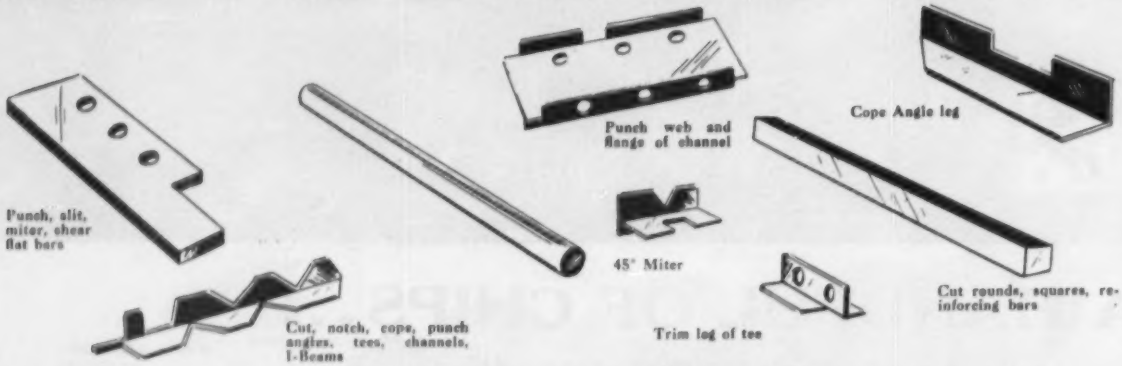
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

IF YOU DO 1/2 OF THESE OPERATIONS

YOU COULD BE SAVING TIME, SPACE AND MONEY WITH A U. I. W.


Punch, slit, miter, shear flat bars
Cut, notch, cope, punch angles, tees, channels, I-Beams
Punch web and flange of channel
45° Miter
Trim leg of tee
Cope Angle leg
Cut rounds, squares, reinforcing bars

Yes, if your shop does only *half* the above fabrication jobs, a "Buffalo" Universal Iron Worker would pay for itself in a hurry. Three men can use it at a time—on three separate operations. It will do up to six operations without tool changes. The only machine with independent built-in notcher and coper, the U.I.W. also has punch head, shear, bar cutter and angle miter with quick pin adjustment. And for the largest capacity work, "Buffalo" also build Unistructural Iron Workers. All are built to the "Q" Factor* standard of strength, convenient handling and freedom from maintenance worries. Write for Bulletin 360-F today!

**The "Q" Factor—the built-in Quality which provides trouble-free saisfaction and long life.*

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

Machine Tool Division

509 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

in greater St. Petersburg

where work and play are combined—

PROFITABLY! Join these 24 major business firms who have located in this area during the past thirty months. Qualified workers, excellent schools, recreational and cultural activities, fine transportation, well-balanced industrial and commercial growth, outstanding community spirit and progressiveness . . . an ideal area in which to locate *your* industry. Write today for detailed literature.

ST. PETERSBURG CHAMBER OF COMMERCE

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WHERE COST is a PRIME CONSIDERATION . . . Investigate INVESTMENT CASTING

This part, of 18-8 Stainless is used for Aircraft Electrical Harness Assemblies. Formerly made as two separate pieces and brazed—it is now cast in one piece.

Here is the highly efficient way to produce accurate castings with close tolerances. If material and labor costs have you concerned, a careful analysis of your multiple machining operations will point up Investment Casting as your best bet to SAVE UP TO 61% ON LABOR, TOOLING, MACHINING AND ASSEMBLY TIME.

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QUALITY CONTROL—We guarantee our work by virtue of complete inspection facilities: X-Ray, Zyglo, Heat Treating Facilities, Etc.

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INVESTMENT CASTING CO.

60 BROWN AVENUE • SPRINGFIELD, N. J.

IN CUTTING-OFF OPERATIONS

. . . speed without Accuracy is COSTLY!

Efficient cut-off of steel blanks from bars demands a combination of speed and accuracy. MARVEL and MARVEL alone achieves this combination with hack saw machines capable of delivering feeds and speeds which fully utilize the strength and heat resistance of the modern high speed hack saw blade.

Exclusive MARVEL dual power feed and crank lever method of reciprocation employed on the Series No. 6 and No. 9 Ball Bearing Hack Saw Machines provide increased speed and efficiency to the cut-off operation. Accuracy is assured by the construction of the machine itself.

MARVEL saws and blades form a team that guarantees the fastest, most accurate cutting-off combination.

PS-1200

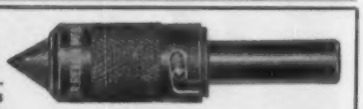
For further information send for catalog C55 and the name of your nearest MARVEL field engineer.

ARMSTRONG-BLUM MFG. CO.

5700 W. Bloomingdale Ave., Chicago 39, U.S.A.

Manufacturers of the Outstanding MARVEL Metal Saws

Abrasive Cent-R-Lap Tool



Saves time, eliminates diamond dressing. Cones changed in seconds. Available in 2 sizes, ⅜" and ½" Cent-R-Laps and abrasive cones in leading grits. Write for descriptive literature and prices.

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Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

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Dore Schary, Head of M-G-M Studios, tells how:

"I send Liz Taylor home every night!"

" 'Raintree County' is colossal in every respect – including its problems! Shooting schedules have to be kept. Release dates have to be met. Over $5,000,000 is at stake!

"Yet, each night we have to send Elizabeth Taylor's 'rushes' – and all the others, too – from location in Kentucky back to Hollywood for processing. Then, re-take if necessary – or go ahead.

"We never slipped off schedule – thanks to Air Express!

"With Air Express picking up the cans of film, flying them out immediately, meeting them by radio-controlled truck for faster delivery – this major problem was solved without a single delay!

"And yet, most of our shipments cost less than any other air service. 15 lbs., for instance, Lexington, Kentucky, to Los Angeles, California, is $10.91. It's the lowest-priced complete air service by $1.09!"

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CALL AIR EXPRESS . . . *division of* RAILWAY EXPRESS AGENCY

PUT YOUR BEST FOOT

UNDER YOUR MACHINES

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ALL METAL INDUSTRIAL

SHOCK AND VIBRATION MOUNTS

When you put a machine on Robinson all-metal industrial mounts, you accomplish three things.

- First, you lengthen machine life and increase and improve its performance.
- Second, you decrease machine sound and vibration transmission to and from the floor (and to your workers.)
- Third, you provide for machine mobility when needed, with none of the time and labor expense of lagging the machine to the floor.

Send for Bulletin 1000.

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TETERBORO, NEW JERSEY
Vibration Control Engineers
INDUSTRIAL DIVISION

WEST COAST ENGINEERING OFFICE
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Quality Control plus Cost Control

Wilder MICRO-PROJECTOR
with VERTICAL LIGHT BEAM

New model long range measuring stage 1" x 4" reading to .0005".

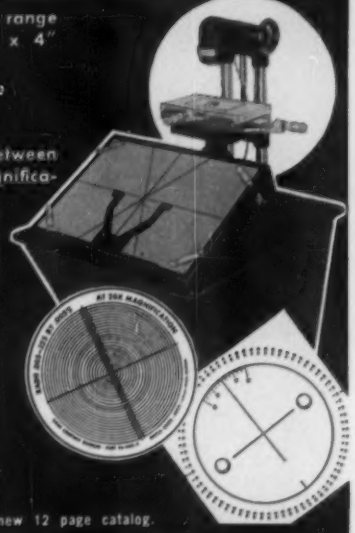
DO IT BETTER

Full set of lenses between 10X and 100X magnifications.

QUICKER

Completely versatile. Available as a basic unit for production inspection or as a completely equipped contour measuring projector.

AT LESS COST



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This low cost machine will handle internal keyseating jobs up to 1 in.

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DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

POPE PRECISION SPINDLES for Grinding, Boring, Milling

Belt Driven • Motorized • High Cycle • Special

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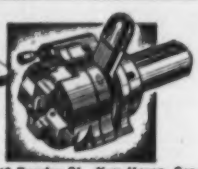
See the Index of Products Advertised in each issue. You'll find products advertised classified by type with page numbers of the advertisements.

AMERICAN MACHINIST
McGraw-Hill Building, New York 36, N. Y.

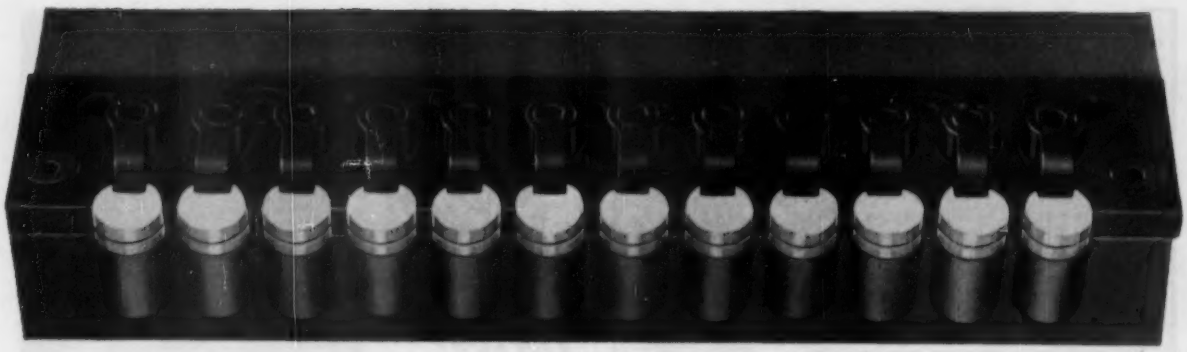
H&G Insert Chaser DIE HEADS



famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
Pacific Coast Rep: *A. C. Berhringer, Inc., 334 N. San Pedro St., Los Angeles, Calif.* Canada: *F. F. Barber Machinery Co., Toronto, Can.*

CALL AIR EXPRESS . . . division of RAILWAY EXPRESS AGENCY



Kendex* multiple grooving tool, with 12 Kennametal "turnover" button inserts, and shims of Kennametal for fast groove cutting and rapid, accurate indexing

KENNAMETAL* Tooling for Special Jobs

Kendex principle is adaptable to a wide variety of job requirements

Many machining jobs often can be done better, faster, or at less cost with a new cutting tool . . . or a tool that is adapted to the existing conditions. The photographs illustrate this point, showing Kendex* Tooling re-designed for specific jobs.

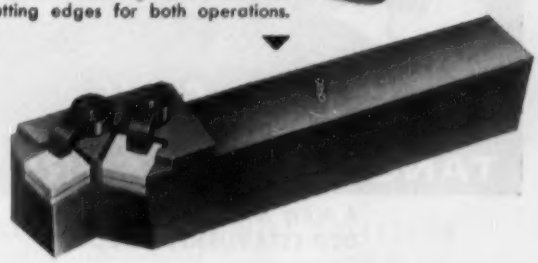
Experienced Kennametal engineers will work with you to find the best approach to your metal-cutting problems. Often a modified standard tool is the answer, and your Kennametal tool engineer will recommend it. Sometimes an entirely new approach with specialized tooling may be the only solution to improve production. In either case, the chances are that Kennametal's experience during the last 18 years has solved a similar problem. Result: Time is saved . . . development work is reduced to a minimum . . . the basic design has been proven.

If you have a stubborn, high-cost production job, perhaps your Kennametal tool engineer can quickly suggest a solution. He devotes his time exclusively to tooling problems with one objective —to get the right tool and right grade of Kennametal on the job. His broad experience in tool design and tool application is supplemented by that of our Research and Engineering staffs. All are constantly at work to provide the best tools and most practical techniques for metal-cutting and forming operations. Call your Kennametal Representative or write to KENNAMETAL INC., Latrobe, Pa.

*Trademarks

Boring bar utilizing Kendex clamped-holder principle and Kennametal triangular inserts of the "turn-over" throw-away type . . . eliminates grinding . . . reduces downtime.

Facing and chamfering completed in one pass with a two-in-one Kendex Tool and Kennametal inserts. Another advantage: Since only the middle of chamfering insert is used, the two inserts may be interchanged after use, thus doubling the number of cutting edges for both operations.



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WEAR AND HEAT-RESISTANT PARTS
INDUSTRY AND KENNAMETAL ...Partners in Progress
ABRASION, CORROSION-RESISTANT PARTS
PERCUSSION AND IMPACT PARTS

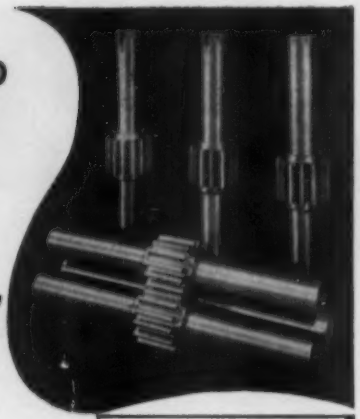
WORLD'S HARDEST METAL

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 58-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

ALLOY FORGED STEEL SHAFT

Spur Pinions



The alloy forged steel shaft spur pinions illustrated were precision-made by Stahl for use on forging presses. Your own gear needs can be equally well met by availing yourself of Stahl's specialized experience. For gears of any material—any size—any quantity—get Stahl's estimate first!

SPURS TO 72" PD, 1 DP
BEVELS TO 54" PD, 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD, 2 DP
CONTINUOUS-TOOTH HERRINGBONE TO 60" PD, 2 DP
SPROCKETS TO 72" PD, 2½" CP
RACKS TO 20 FT. LONG, 3 DP
SILENT GEARS; RAWHIDE, BAKELITE, FIBROIL
HEAT-TREATED, CASE OR FLAME HARDENED GEARS—OF CARBON OR ALLOY STEEL

Stahl

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3901 Hamilton Ave. Cleveland 14, Ohio

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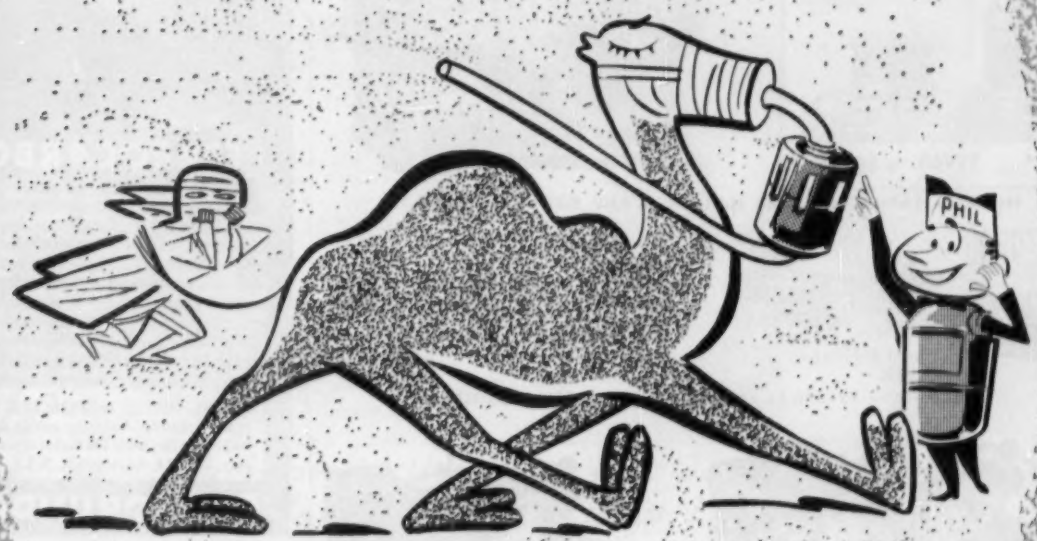

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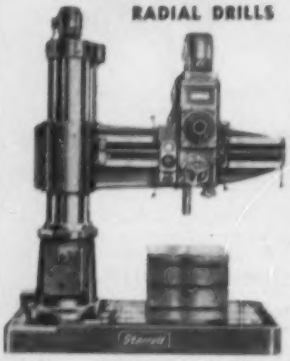

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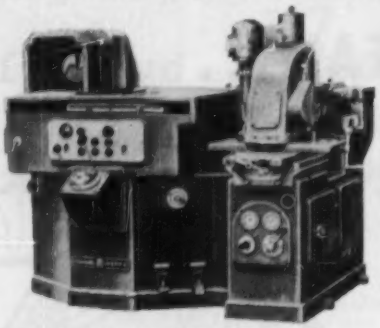

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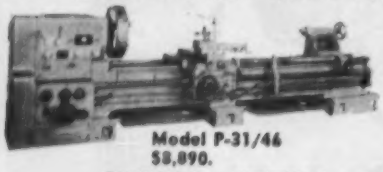

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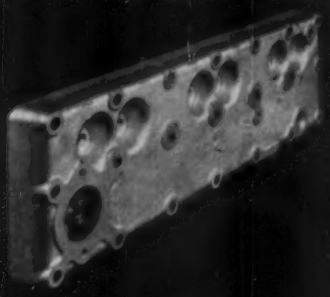

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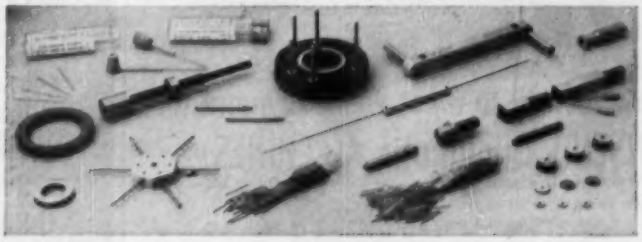

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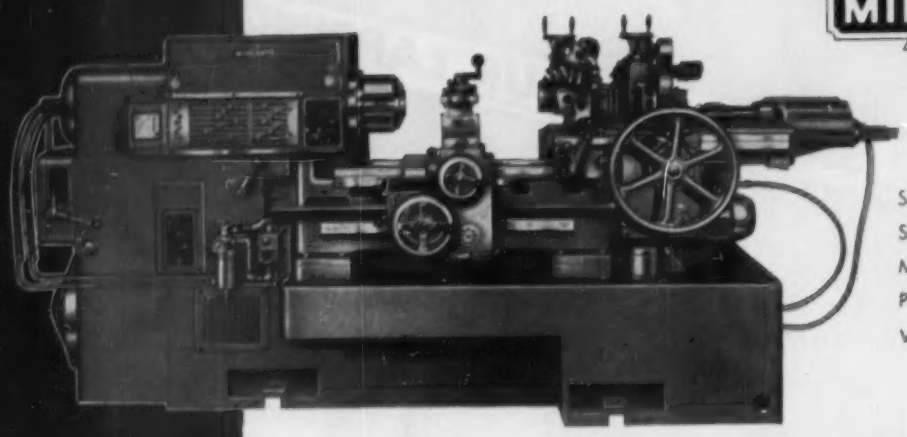

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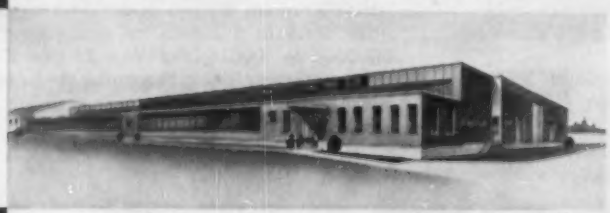

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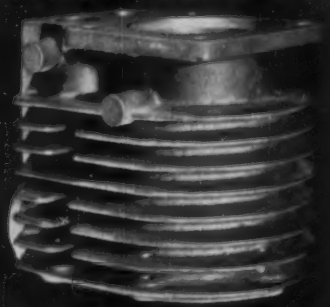

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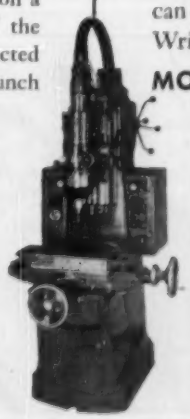

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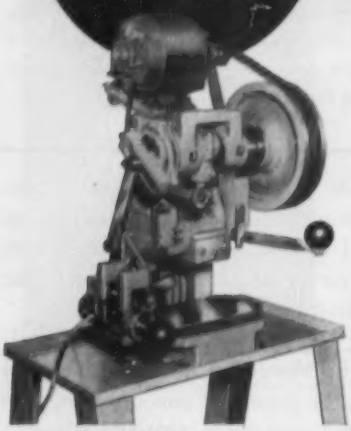

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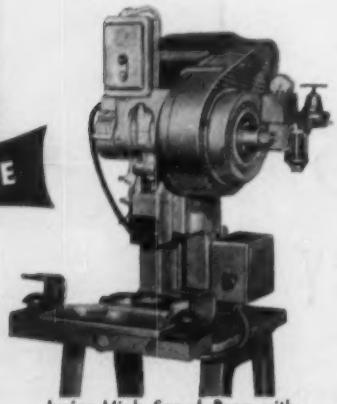

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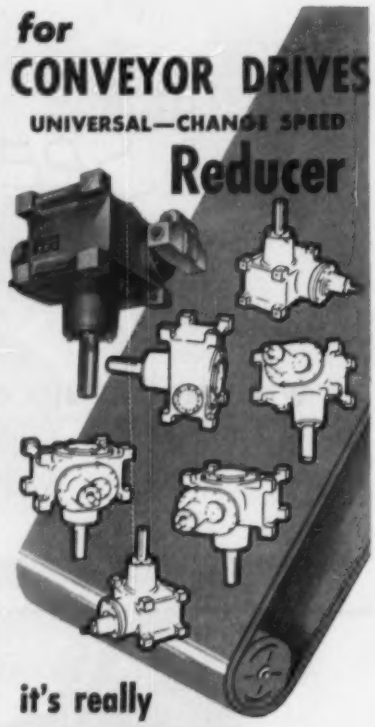

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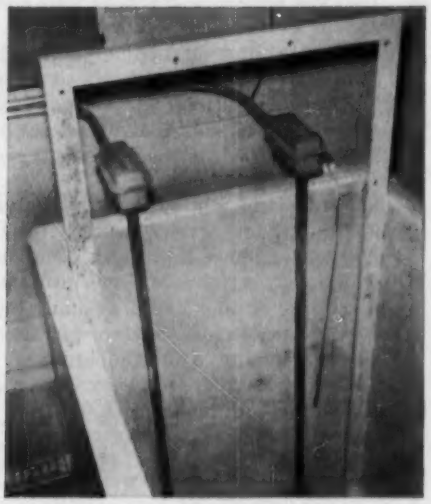

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Gaging . . .

the Surplus Machinery Market

"This business would be wonderful today if it weren't for two things," a Midwestern dealer told us, "—the money market is getting tighter and tighter all the time, and every customer who comes in wants the same thing—an almost new machine."

That last sentiment is echoed time and again out on the Pacific Coast and in the East, where availability of top-quality used machine tools is lagging far behind the market. Best place to get hold of comparatively new machines, it seems, is now Chicago or Detroit. San Francisco dealers, for example are doing a lot of their buying in the Midwest, and they aren't at all worried about getting a price high enough to justify the freight costs.

Sales demand, while it has been fluctuating up and down somewhat in the last few weeks, has generally been on the rise. But, again, it's getting more and more difficult to get hold of quality used equipment. At almost every private or auction sale today, you'll find three or four times as many bidders as would have attended a year ago. But the bidders are mostly direct buyers from metalworking plants. The comparatively few dealers who do attend such sales are there for one of two reasons—either they're trying to build up their inventories, or they have commissions from customers in their pockets.

At the recent Omaha, Neb. and Park Ridge, Ill, sales of government-owned surplus machine tools, at least 30 to 40% of the sales went either directly to customers or to dealers buying on direct commissions. As a result, those dealers trying to build up inventory of late-model machines had a rough time, but it's axiomatic that "You can't sell from an empty wagon."

That's why you'll find the dealers bidding top prices at auctions and sales right along with everybody else, but it's putting a terrific squeeze on profit margins. For instance, one dealer claims his total sales for this year wll run 15 to 20% ahead of last year, but his profits will be the same or a little less.

Adding to the probems that face the surplus machinery dealer is the reluctance of metalworking plants to get rid of surplus machines, even at today's top prices. Either the plants are holding on to them because they think prices will go even higher, or they're afraid that they might get caught in their own trap: that if they sell now and need similar machines in a year or so they may have to pay a lot more to get them back.

Spot report—Los Angeles: activity is still very high out here, although the usual December holiday slump is making itself felt. Dealers here believe 1956's sales bettered last year's by a good 15 to 20%, but profits wil range from under-1955 levels to "perhaps just a little better" because of the current high costs of buying and of repair work. While prices to consumers have been pushed up, they haven't kept pace with the rise in prices to dealers.

Los Angeles dealers expect 1957 demand to be at least as good because of the enormous jump in aircraft contracts. Says one dealer, "We have no qualms about demand out here. The hitch is whether we can get hold of the machinery to meet demand. "We're not at all sure we can find it."

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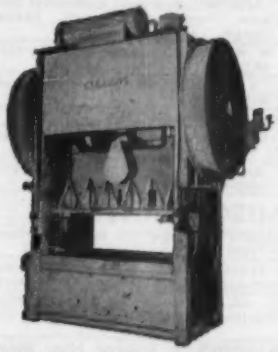

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No. 5 Abrasive 12"x60" surface grinder, horiz spdl.
No. 2 Standard Brown & Sharpe vertical mill, new 1943.
No. 3 Gisholt ram type universal turret lathes (2), new 1942.
No. 5 Gisholt ram type universal turret lathe, new 1940. Arr. bar & chucking.
Models BL2416-BL3616 F & W Keller machines (2) one late
14" x 42" cc Hendey toolroom engine lathe, new 1940.
No. 5-48 Cincinnati hydromatic duplex mill, late
No. 4 Cincinnati high-power plain horizontal mill, serial E506J.
No. 4 Gallmeyer & Livingstone universal tool & cutter grinder, new 1941.
5' arm 13" col. Fosdick "Economax" hydraulic radial drill, new 1943.

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3" Univ. Triway, Thin
10' Niles, 2 Hds., PRT
52" King, 2 Hds., PRT
36" & 24" Bullard New Eras
GRINDERS, 10"x60" Cinci. Cyl. Pl.
No. 36 Hanchett 36" Vert. Rotary
No. 16 Blanchard 30" Vert. Rotary
36"x42" Pratt & Whitney Die & Srf.
60" Hanchett Vert. Spin. No. 500
10"x20" B. & S. No. 1 Univ. '42
LATHES, 120" x 96" to 12" x 6'
TURRETS, Nos. 2H-16 & H5 Libbys
Nos. 3AL, 2L & 5 Gisholts
Nos. 2 & 2G Moreys, 1" capty.
MILLERS, Nos. 5 HP Cinci. Pl. & Univ. (2)
No. 22LU Van Norman '44
No. 2 Cinci. Dial. Univ. '43
375 Allwood Rd., Clifton, New Jersey
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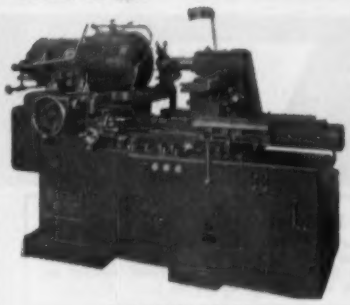
CINCINNATI No. 1-30 Stroke Vertical Duplex; hyd.
COLONIAL Model VGI 10-48 Stroke Vertical; hyd.
LAPOINTE No. 3 Double Spindle, M.D.
LAPOINT Model SRV 10-54 Stroke Vertical; hyd.
LAPOINTE SRV 15/66" Stroke Vertical; hyd., late
OILGEAR Type XL, 6-ton, 36" Stroke; horiz., late

DRILLS, RADIAL
AMERICAN 7' arm 16" Column Plain; motor drive
CINCINNATI BICKFORD 4' arm 11" Column Plain; "Super Service"; motor on arm
CINCINNATI BICKFORD 5' arm 13" Column Plain
CINCINNATI BICKFORD 6' arm 19" Universal, M.D.
CINCINNATI BICKFORD 6' arm 17" Column Plain, "Super Service" motor on arm
MORRIS 3' arm 11" Column Plain; late type

GEAR EQUIPMENT, MISCELLANEOUS
BILGRAM 6" Bevel Gear Generator; 1 D.P.; M.D.
BILGRAM 16" Bevel Gear Generator; 2 D.P.; M.D.
BROWN & SHARPE No. 1 Spur Gear Tester
BROWN & SHARPE No. 13 Straight & Bevel Auto. Gear Cutter; 18" cap., 4 D.P., M.D.
BROWN & SHARPE No. 14 Straight & Bevel Auto. Gear Cutter; 34" cap.; late type
CINCINNATI No. 4 Auto. Gear Cutter; cap. 36"; 2½ D.P.; late type
CINCINNATI No. 6A Auto. Gear Cutter; cap. 72"; 1½ D.P.; late type
CROSS No. 1 Gear Tooth Rounding Machine, cap. 4 pitch or finer to 24" dia.; 2 pitch or finer to 6" dia.
CROSS No. 40 Gear Tooth Pointing & Chamfering Machine; gear face 10", gear dia. 20".
CROSS No. 45 Gear Chamfering Machine; late type
DETROIT Type GG-35 Gear Grinder; late type
GOULD & EBERHARDT No. 36BM; 3-Spindle Gear Rougher; 2 D.P.; M.D.
GOULD & EBERHARDT No. 36BT Gear Rougher; 4 D.P.; M.D.
PRATT & WHITNEY 10" Gear Grinder; single wheel type; cap. 10-11/16"
PRATT & WHITNEY 26" Universal Hyd. Gear Grinder; single wheel; pitch range 2 to 12; late type
ROBEY SMITH No. 1 Straight Bevel Gear Planer
SHEFFIELD (Cimatool) No. 201A Auto. Burring Machine; late type



BRYANT No. 112Y
Hydraulic Internal Grinder, latest type.

GEAR EQUIPMENT—HOBBING
BARBER COLMAN Type A; cap. 12"x12" 3 D.P.
BARBER COLMAN Type G Auto. Gear Hobbing Machine No. 1 1" dia. Brass 24 D.P., steel 32 D.P.
BARBER COLMAN Type T; 12"x12" cap.; 3 D.P.
BARBER COLMAN Model 8-10 Model (type V) Vertical; cap. 8"; 4½ D.P., late type
BARBER COLMAN No. 12 single overarm; 12"x12"
BARBER COLMAN No. 17 cap. 9"; 2½ D.P.; M.D.
GOULD & EBERHARDT No. 8H Universal; cap. 12"; 4 D.P., M.D.
GOULD & EBERHARDT Model 24-H Universal 27" cap.; 3½ D.P., late type
GOULD & EBERHARDT 12H Heavy Univ. cap. 12"; 4 D.P., M.D.
GOULD & EBERHARDT No. 24-H; cap. 16"; 3½ D.P.
HERCULES 8" Gear Hobbing Machine, M.D.
KOEPFER Model WM-11 Automatic Gear Cutter; 24 D.P., late type

GRINDERS, PLAIN CYLINDRICAL
CINCINNATI 4"x12" Centers Model 0H "Filmatic"; New 1950
LANDIS 4"x12" Centers Type H Hyd., late type
LANDIS 4"x18" Centers Type H Hyd., late type
LANDIS 6"x18" Centers; M.D.
LANDIS 10"x19" Centers Type C Hyd., late type
LANDIS 10"x36" Centers Type DC Heavy Hyd.
LANDIS 10"x36" Centers; M.D.
LANDIS 10"x72" Centers Type DC Heavy Hyd.
LANDIS 10"x96" Centers Type C Hyd., late type
LANDIS 16"x120" Centers, Type B; late type
NORTON 4"x12" Centers Type CTU Hyd., 1951
NORTON 10"x18" Centers Type C Hyd.; late type
NORTON 10"x36" Centers; Motor Drive
NORTON 10"x48" Centers Type C Hyd.; late type
NORTON 14"x72" Centers Type C; late type
NORTON 14/22"x36" Centers Type C "Gap Type"
NORTON 16"x48" Centers Type C; late type

GRINDERS, SURFACE
BILLITER & KLUNZ Type BS 5000 Way Grinder; 48"x199" cap.; late type
HEALD No. 22 Rotary Surface Grinder 12" Chuck
HEALD No. 25A Rotary Surface Grinder 30" Chuck
MATTISON 14"x16"x60" High Power "Precision" Hyd.; late type
MATTISON 14"x24"x72" High Power "Precision"
MATTISON 16"x24"x120" High Power "Precision"
NORTON 6"x18" Horizontal Spindle Hydraulic; late
NORTON 6"x18" Vertical Spindle Hydraulic; late Hydraulic; late type
PRATT & WHITNEY 14"x36" Vertical Spindle
BLANCHARD No. 16, 26" Magnetic Chuck; Hyd.
BLANCHARD No. 16, cap. 36"x12", 36" Magnetic Chuck; late type
BLANCHARD No. 18, 42" dia. Magnetic Chuck; 1950
GALLMEYER & LIVINGSTON No. 45, cap. 12"x24"

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LATHES, TURRET
GISHOLT No. 1L Univ. Saddle Type; Swing 19"
GISHOLT No. 2L Saddle Type Swing 22½"; cross sliding turret; late type
GISHOLT No. 3 Univ. Ram Type Swing 13½"; late
GISHOLT No. 4 Ram Type; Swing 30"; late type
GISHOLT No. 5 Univ. Ram Type Preselector Head; Swing 19½"; late type
JONES & LAMSON No. 3 Univ. Ram Type; Swing 21¼"; late type
LIBBY (INTERNATIONAL) Model 4H-12 Saddle Type; Swing 32"; cross sliding turret
MOREY No. 2 Ram Type; Swing 14"; late type
MOREY No. 3 Univ. Ram Type Swing 16½"; late type
MOREY No. 4 Univ. Ram Type Swing 19½"; late type
WARNER & SWASEY No. 1 "Electric"; swing 11"
WARNER & SWASEY No. 1A Univ. Saddle Type; Swing 18"; late type
WARNER & SWASEY No. 3A Univ. Saddle Type; Swing 21½"; late type
WARNER & SWASEY No. 3 Ram Type; Swing 21¼"
WARNER & SWASEY No. 5A Univ. Saddle Type; Swing 24½"; late type
WARNER & SWASEY No. 4 Univ. Ram Type Preselector Head; Swing 18½"; for Bar or Chucking

PLANERS
GRAY 48" x 48" x 10' "Maximum Service"; 4 heads; Power Rapid Traverse; D.C. Reversing
LIBERTY 144"x76"x48" adj. openside; 1 table; 4 hds.; vari-voltage; Power Rapid Traverse; M.D.; late type; NEW 1949
NILES 48"x48"x10' double 4 hds., PRT M.D.
NILES BEMENT POND 72" x 72" x 30"; 4 hds.; Power Rapid Traverse; D.C.; M.D.
NILES BEMENT POND 60" x 60" x 14' double housing; late type
SELLERS 48" x 48" x 14' Double Housing; late type
SOUTHWARK No. 1; 16' Plate Edge Planer

SCREW MACHINES, AUTOMATIC BAR OR CHUCKING
ACME GRIDLEY Model RB 6 Spindle 2" High Speed; New 1951
BROWN & SHARPE No. 00G—Auto. Cap. ⅝" Round; late type
CLEVELAND 1¼" Model A Single Spindle Auto.
CLEVELAND 3½" Model A Single Spindle Auto.
CLEVELAND 7½" Model A Single Spindle; Auto.
CONOMATIC 1⅞" 6-Spindle Automatic; late type
CONOMATIC 4⅜" 4-Spindle Automatic; late type
NEW BRITAIN GRIDLEY Model 85—6-Spindle Automatic Chucking; late type
GREENLEE 1-5/8" Six-Spindle Automatic; late type
GYROMATIC "TAVANNES" No. 40 6-Spindle Auto.
CONOMATIC 1⅝" 6-Spindle Automatic; late type
CONOMATIC 1⅝" 6-Spindle Automatic; late type
CLEVELAND 1½" Model A; 4-Spindle Automatic
CLEVELAND 2½" Model A; Single Spindle Auto.
GREENLEE 1⅝" 6-Spindle Automatic; late type

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24" x 12' BOYE & EMMES Grd. Head, Timken Bearing, Taper Attachment.

4 DE POTTER & JOHNSTON Automatic Turret Lathe, Late Type.

24", 36" BULLARD Vertical Turret Lathe, Turret Hd., Side Hd., M.D.

No. 2, 3, 4, 6 WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

No 2, 7 BARDONS & OLIVER Universal Turret Lathes, Preselector, Bar & Chucking, Late Type.

17" x 8' LoBlond Regal Grd. Hd. Lathe, M.D.

DRILLING MACHINES

28" BARNES Upright Drill Press No. 242 M.D. Box Column, Power Feed.

3', 4', 5', 6' CINCINNATI BICKFORD Radial Drills.

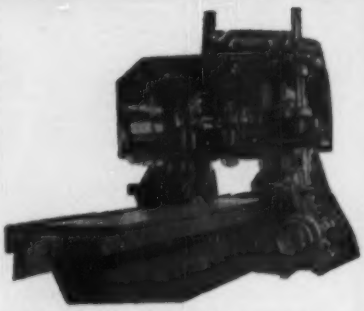
No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

MILLS

0-8 CINCINNATI Horizontal & Vertical Prod. Mills, M.D.

No. 2HL Kearney & Trecker Horiz. Mill, M.D., Late Type.

1A PRATT & WHITNEY Jig Borer, with Gauges, Rods, Collets and Chuck.



No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late.

42" by 36" x 12" INGERSOLL Planer Type Mill, two heads on rail, two side heads, M.D.

48" CINCINNATI Duplex Automatic Prod. Mill, M.D.

No. 2, 3, 4, 5 CINCINNATI Hi Power Horiz. Mills, M.D.

PRESSES

No. 6 BLISS Straight Side Press Double Crank 135 Tons Cap., Motor Driven.

400 Tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12" to End Support, M.D.

3W WATERBURY FARREL Hi-Speed Blanking, 60 Tons Cap., 1½" Stroke, Reeves Drive.

GRINDERS

No. 13 BROWN & SHARPE Universal Tool & Cutter Grinder, Complete Tooling.

4' x 12' LANDIS Hydraulic Plain Cylindrical Grinder, M.D. Late Type.

6" x 18" NORTON Hydraulic Horizontal Surface Grinder, Permanent Magnetic Chuck, Coolant System, Late Type.

No. 14 W HAMMOND Double End Carbide Grinder, M.D.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

4T SELLERS Tool Grinder, M.D. Late Type.

30" INGERSOLL Face Mill Cutter Grinder, M.D. Late Type.

6" x 18" LANDIS Type "C" M.D. Hyd., Cylindrical Grinder, Serial #29196.

MISCELLANEOUS

18 KW SCIENTIFIC ELECTRIC Induction Heater, Tube Type.

No. 8LS FELLOWS M.D. Gear Lapping Machine, Detachable Head, Univ. Work Support.

1AA, 3A, 4A, 5½B, 7B ROCHESTER High Speed Rivetting Hammers & Staking Machines.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, M.D. Late Type.

No. 6 BROWN & SHARPE Automatic Screw Machine, M.D., 2" Capacity.

8' x 18 Ga. Wysong & Miles Foot Shear, Late

No. 194 BARNES Vertical Hone, 4" Capacity, 12" Stroke, M.D.

12" PRATT & WHITNEY Vertical Shaper, Keller Attachment, Late Type.

8" CLEVELAND Model A Automatic Screw Machine, Late Type.

15' x 10' x 36' BETTS Double Housing Planer, 4 Swivel Heads, Pendant Control, Box Table, Motor Driven.

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No. 18 Blanchard Vertical Surface Grinder, 30" Magnetic Chuck, 35 H.P. 440-3-60 Motor Drive, 2 H.P. A.C. Table Motor Drive, Work Range 30" x 12", 18" Dia. Wheel Speed 720 R.P.M., 6 Chuck Speeds 6-33 R.P.M. Wheel raised or lowered by hand or power, Serial #2658 OUR PRICE $6950.00.

PARTIAL LISTING
BORING MACHINES

Forte-Burt Vert. 50" sw. new 1941
#40 Heald Boromatic, new 1944
5½" Bar Cinn.-Gilbert Floor Type

DRILLS

1 spdl. 14" sw. #2 Avey, new 1945
1 spdl. 20" sw. #3LMB L-G, 1945
1 spdl. 24" sw. #3MAG Avey, new 1943
1 spdl. 26" sw. #4MB L-G hydraulic
2 spdl. 24" sw. #3 Avey, AC MD
3 spdl. 20" sw. #2LMB L-G, 1942
3 spdl. 24" sw. #3MB L-G, new 1943
6 spdl. 30" sw. #1LMB L-G, new 1943
#31-A Baker Univ. H.D., 1942
16 spdl. Fox #K6dH, #2 taper, 1944

GRINDERS

3"x12" #5 B&S, 1943
3"x18" #6 B&S, 1943
4"x12" #4H Landis, New 1942
6"x18" Norton Type C, new 1943
10"x18" Norton Type C, new 1941
10"x36" Norton Type C, new 1942
10"x48" Norton Type C, new 1943
10" (28" sw.) 2 & 4S" Cinn. EH, 1943
10"x36" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
14"x72" Norton Type C, new 1941.
14"x96" Hill-Clarke, A.C. Mot. Dr.
16"-20"x96" Norton Gap, 1942
16"-40"x96" Norton Gap, 1942
16"x72" Hill-Clarke, A.C. Mot. Dr.
16"-36"x72" Norton, AC MD 1941
16"x96" Hill-Clarke, AC Mot. Dr.
18"x120" Norton, AC MD.
20"-32"x144" Norton Pl. Cyl.
22"x36" Norton, Hi-Swing
24"x204" Norton, AC MD
42"x72" Norton, extras, new 1947
#8A Bryant Internal, new 1943
#10A-16 Bryant Internal, new 1942
#16-36 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sizematic, 1944
#72A5 Heald Internal, new 1943
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc, 1940
3B Abrasive Belt, 6"x24", 1943
#18-30" Blanchard Rot. Surf.

LATHES

18ML 18"x36" LaBlond Auto.
12"x30" Handey Lathe, Taper Att.
12"x28" Lipe Carbo Semi-Auto
12"x35" Fay Automatic
12"x45" Fay Automatic
14"x36" Amer. Grd. Hd., MD
27"x41" Amer. Grd. Hd., MD
24"x42" Fay Auto. AC MD
36"x126" Putnam Grd. Hd., MD
R14 Seneca Falls, 14"x30", 1943
120"x96" or N-B-P, ser. 3330
#5W Cinn Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1942
#AA W&S Turret Ser 338968
4FU Fasternatic, tur. 32" sw. 1944
8D Potter & Johnston, new 1941

MILLERS

54"x30"x16' Ingersoll Slab, 1934
54"x60"x8' Ingersoll Openside, 1942
54" Ingersoll Vertical Rotary
Davis & Thompson Vert. 1944
#12-B Pratt & Whitney Profilers
16"x60" F&W Med. B. Thread Mill
#LT 6"x12" L. B Thread Mill
#HT 12"x24" L-B Thread, 1942
#CT 24"x36" L-B Thread, 1942
No. 2 Cinn. Univ. Hi-Power
#116 Van Norman Prod. 1942

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x27' American, 4 hds.
60"x48"x30' Hamilton, 4 heads

MISCELLANEOUS

6" Goss & DeLeeuw 8 spdls. 1941
#306 Barnes Vert. Hone, new 1942
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 2 Spdl. Bevel Gear
612-A Fellows Gr Shaper 18" ram
#HBS Barber-Colman Sharp Mach
15 Ton Toledo Overhd. Crane, 30½

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SURFACE GRINDERS

No. 16 Blanchard Rotary, m.d.
No. 16A-2 Blanchard Auto. Rotary, m.d.
No. 2B Brown & Sharpe, m.d.
No. 33 Abrasive, m.d.
14" Pratt & Whitney Vertical, m.d.
14" Pratt & Whitney Model M 1640 Vertical, m.d.
No. A-1-8" Arter Surface Grinder
No. 22—12" Heald Rotary, m.d.
No. 25-A-24" Heald Rotary, m.d.
No. 25-A-30" Heald Rotary, m.d.
No. 2 Brown & Sharpe, m.d.
#300-60 Hanchett Vertical Spindle, m.d.
78" Type NT Rogers Knife Grinder, m.d.
16"x24"x120" Mattison, m.d.
Model T Builders Iron Foundry, m.d.

PLAIN CYLINDRICAL GRINDERS

No. 5 Brown & Sharpe Plain Cylindrical, m.d., 1942
6x18" Cincinnati Plain Hydraulic, m.d.
6x18" Cincinnati Model EA, m.d.
6x18" Cincinnati Model ER, Plain Hydraulic, m.d., Filmatic Spindle
6x18" Landis Type C Hydraulic, m.d., late
10x18" Cincinnati Plain Hydraulic, Model ER, m.d., Filmatic Spindle, 1943
10x18" Cincinnati Model EA, m.d.
10x18" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x36" Norton Type C, m.d.
10x72" Landis, m.d.
12x36" Landis Plain Self-Contained, m.d.
12x96" Landis Plain Self-Contained, m.d.
14x52" Norton, motorized
16x72" Landis Plain, m.d.
16x72" centers Type C Norton Semi-Auto., Hydraulic
16x96" Cincinnati Plain Cylindrical, m.d.
16" raised to 20" size x 72" centers Norton, Type C, m.d
18"x72" Norton Type C, mechanical m.d.
20"x120" Landis Plain Self-Contained, m.d.

UNIVERSAL GRINDERS

No. 2 Brown & Sharpe, 14"x30" centers cap., m.d.
No. 3 Brown & Sharpe, 14"x30" centers cap., m.d.
10x24" Landis Type C, m.d.
12x48" Norton Universal, m.d., latest
14x48" Landis Universal
18x66" Landis Universal, m.d., Type C

HONING MACHINES

No. 3 Barnes Single Spindle Horizontal Internal Hone, new
No. 182 Barnesdrill, m.d.
No. 654 Micromatic Vertical Honing Machine, m.d.
H1 Micromatic Horizontal Hydrohoner, m.d.
H4 Micromatic Horizontal Hydrohoner, m.d.
No. 6 Barnes Twin Spindle
No. 306H Barnes Single Spindle
No. 224B Barnes Honing Machine, m.d.

THREAD GRINDERS

No. 33 Excello Precision, m.d.

INTERNAL GRINDERS

Type 16 103 Gremby, m.d.
No. 5 Bryant, m.d., latest
Model 5Y Bryant, m.d.
No. 16—16" Bryant, m.d., hydraulic Hole Grinder
No. 16CR16 Bryant, m.d., latest
No. 16—22" Bryant, m.d., latest
No. 16—30" Bryant, m.d., latest
No. 16A-16 Bryant Hole & Face, m.d.
No. 16-A-28" Bryant, m.d.
No. 24-36 Bryant Hole & Face Type, m.d., late
No. 24P—29" Bryant, m.d.
No. 24—21" Bryant, m.d.
No. 24-L-36 Bryant, m.d., late
No. 24-LW-36 Bryant, m.d., late
No. 44 Heald Facing Type Borematic, m.d.
No. 47A Heald Borematic, m.d.
No. 649—16" Van Norman Automatic Oscillating Radius, m.d., latest
No. 70 Heald, motorized 3 motors
No. 70A Heald, m.d., latest
No. 72A Heald Sizematic, "Duplex", m.d.
No. 72A Heald Gagematic, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Plain, m.d.
No. 72A5 Heald Sizematic, m.d.
No. 72A5 Heald Plain, m.d.
No. 73 Heald Airplane, m.d., latest, new
No. 74 Heald, m.d.
No. 74 Heald, Plain Long Base, m.d., 1941
No. 75A Heald, m.d., latest
No. 78 Heald Centerless Cylinder Grinder, m.d.
No. 81 Heald Gagematic, Sizematic, m.d.
No. 81 Heald Plain & Sizematic, m.d.

PUNCHES & SHEARS

No. 7 Thomas Vertical, latest
No. 6½ Hilles & Jones Punch & Shear, single end, type "B"
Cleveland Type G Vertical Shear, 72" throat, m.d.

SNAG GRINDERS

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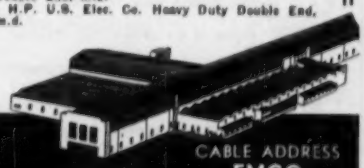

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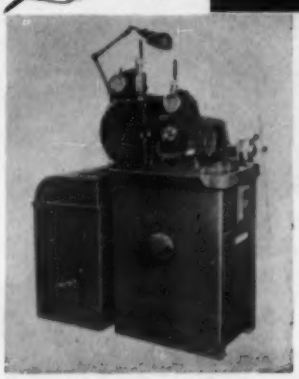

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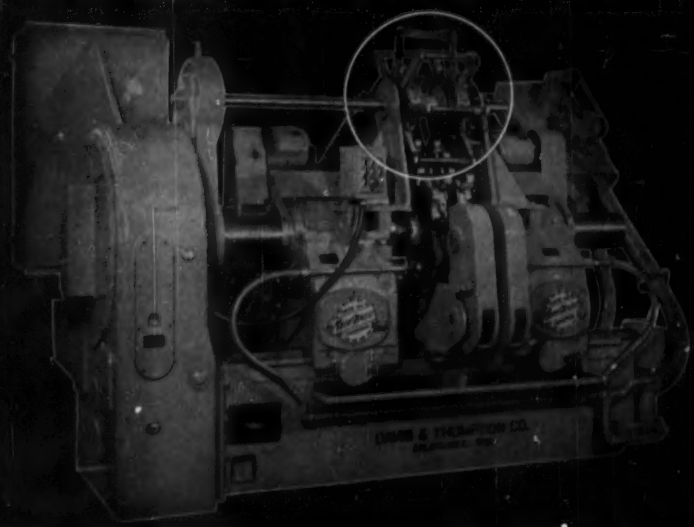

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Basically, this is a standard ROTO-MATIC machine tooled-up to handle special production requirements. Rough and finish milling and centering spindles in both heads have micrometer endwise adjustment. Heads are adjustable on the ways. With equalizing jaws in fixtures plus chain clamping, machine is fully automatic.

If you have work of this nature, consult D&T engineering for further details.

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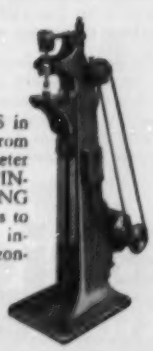

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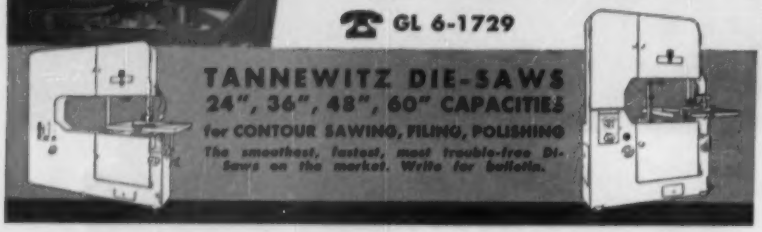

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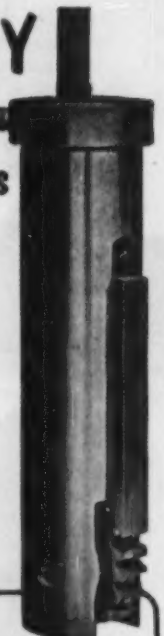

NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations that a keyseating machine can't reach. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

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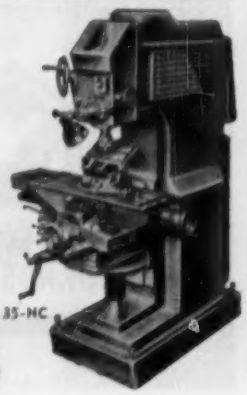

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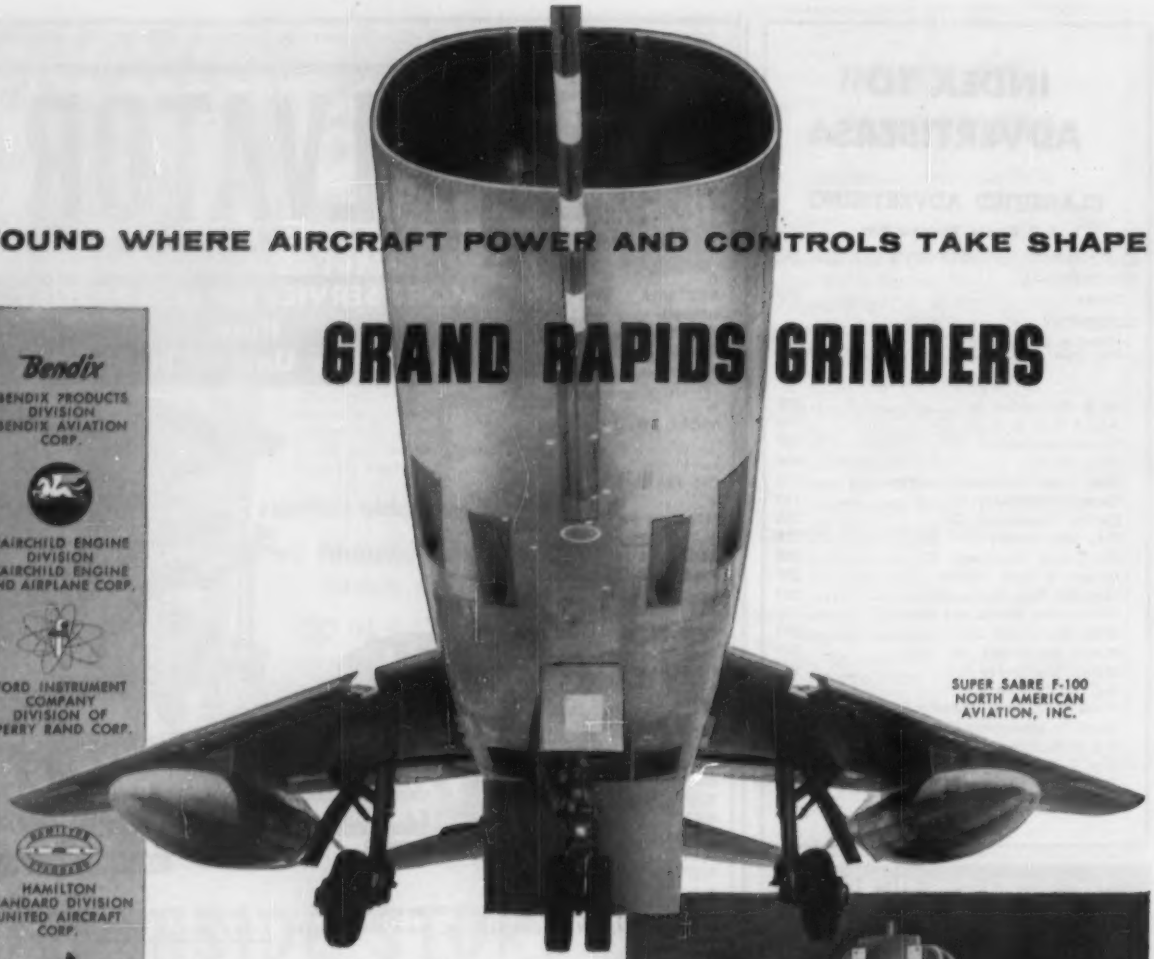

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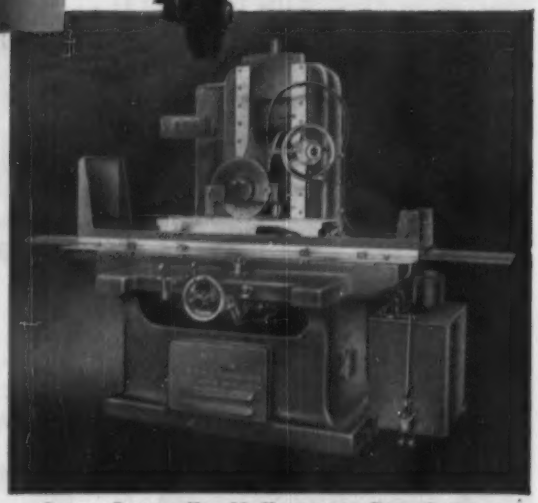
With these built-in precision features typical of all Grand Rapids Grinders, it's no wonder they're found in leading toolrooms.



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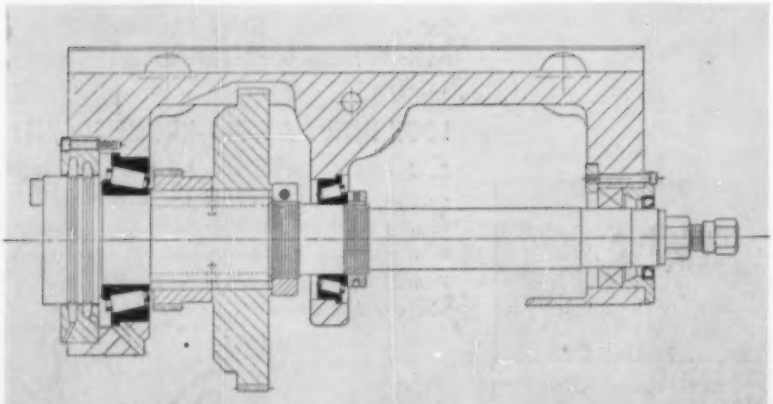
New! Completely redesigned milling machine switches spindle to TIMKEN® bearings



KEMPSMITH MACHINE COMPANY mounts the spindle of their new Kempsmith Master-Mill milling machine on Timken tapered roller bearings to hold spindle in rigid alignment.

THIS Kempsmith Master-Mill, made by Kempsmith Machine Company, is a brand new, improved model—designed to meet new demands for higher production, lower milling costs. Kempsmith switched to Timken® tapered roller bearings on the new Kempsmith Master-Mill to offer users their many advantages on the spindle, on the table leadscrew, on elevating pinion, and cross feed screw.

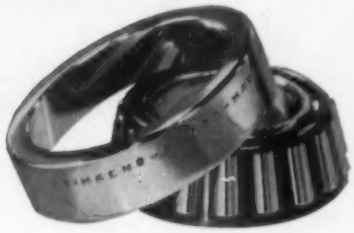
Kempsmith reports that Timken bearings are easier to install and adjust, have greater load capacity in small space, are much easier to preload.

Timken bearings hold the spindle in rigid alignment, meeting the requirement of "zero end play over a 24 to 1500 rpm speed range." Tapered construction lets Timken bearings take the radial and thrust loads encountered by a milling machine spindle, in any combination.

Timken bearings were specified, too, because of the heavy shock loads induced by the milling cutter—shocks further amplified by interrupted cuts. Rollers and races in Timken bearings are case-carburized, with tough, shock-resistant cores under hard wear-resistant surfaces. They'll *take* heavy shock loads! And Timken bearings give extra load-carrying capacity with their full line contact between rollers and races.

Geometrically designed for true rolling motion, Timken bearings are precision-manufactured, under rigid quality controls, to conform to their design. We even make our own steel, something no other American bearing maker does. Buying or building machines like this? Look for the trade-mark "TIMKEN" on every bearing! The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



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